

*Transactions of the
Society of
Medical Officers of Health.*

Session 1883-84.

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OF

Medical Officers of Health.

SESSION 1883-84.



LONDON :

PRINTED AND PUBLISHED BY ROBERTS & LEETE, 57 & 58, TOOLEY STREET, S.E.,
AND 6, LIME STREET SQUARE, E.C.

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TRANSACTIONS OF THE SOCIETY DURING THE SESSION 1883-84.

*Inaugural Address by the President,
T. ORME DUDFIELD, M.D., at the Opening of the
Session, October 19th, 1883.*

Metropolitan Sanitary Administration.

IN the address which it is at once my duty and my privilege to deliver on this the opening night of another session, I take as my subject Sanitary Administration in the Metropolis, and I propose to deal with it under three heads, viz:—1. The need of Unity in Sanitary Administration, 2. How such Unity may be brought about, and 3. The probable Benefits of Unity being attained.

1. *The Need of Unity in Sanitary Administration* can scarcely admit of question when we reflect that the care of the public health in this greatest of cities is committed to the charge of some forty separate authorities created by, and deriving many of their powers from, one and the same Act of Parliament, yet practically independent each in its own district, having no bond of connection enabling them to combine for the common good, and excepting in special and local cases, for special and local objects, rarely holding communication one with another.

The Metropolis stands alone in this respect, being the only city that, so to say, is *not* at unity in itself. In every other large centre of population we see a single authority deriving its powers from consolidated laws, and dealing with every branch of public health and sanitary administration.

The ill effects of what may be called sanitary disunion in London are not far to seek. As regards questions of public health, affecting the whole community, you are aware that, excepting in the case of an emergency, such as an invasion of cholera, when special legislation is called into operation, there are no means of combining the

governing authorities for the common defence. No, not even for so necessary an object as preventing the spread of a loathsome disease like small-pox. An epidemic may break out in one district and prevail for many days without the fact becoming known to the authorities in adjoining districts, and hence no combined measures can be taken for checking or preventing its spread at the onset, when alone a successful result is possible. It may be said, indeed, that, lacking "compulsory notification," the authority of the district first invaded may itself remain but too long in ignorance of the outbreak. This, however, only proves the need of unity, for Parliament could not refuse to a strong central sanitary authority whatever powers experience showed to be necessary to enable it to deal with infectious diseases, however unwilling it might be to entrust such powers to numerous and disunited minor sanitary authorities.

A significant illustration of the need of unity is furnished by the history of the hospitals for infectious diseases. Ever since 1866 the sanitary authorities have had power, separately or collectively, to provide hospitals for the sick in their respective districts; but this power, speaking generally, has not been exercised. And why? It was felt, probably, that the task was too great to be undertaken by each district separately, and there existed no means of compelling adjoining districts to combine for the purpose. In the following year the difficulty was solved in a practical way, but almost, as it were, by accident—viz., by the enactment of a law which, while nominally providing for the needs of paupers only, has actually endowed the metropolis, under a single authority, with an admirable set of hospitals which have become available, and, with proposed additions, will shortly be adequate, for the needs of all classes of the population. The fatal stigma of pauperism until recently nominally attached to these institutions; but, here again, practical common sense overruled strictly legal considerations; for not only did no actual disqualification result from relief administered in the Asylum Board's hospitals, but, what is more, the use of them has been greatly stimulated by the practically free admittance given to all comers. The experiment thus unconsciously made proved so successful, that in the last session a Government measure was introduced and carried, by which the sanction of law has been given to a state of affairs that had grown up contrary to the provisions of law, and such as was never contemplated by the Government which introduced, or the Legislature which enacted, the Metropolitan Poor Act, 1867. And thus it has come to pass that the Society may at length

be congratulated on the adoption by Parliament of a principle for which it was the first, or among the first, to contend - viz., that "The assistance afforded to the Sick in Hospitals, for the Treatment of Infectious Diseases, ought not to be considered Pauper Relief;" the correlated proposition, that "The Hospital Treatment of Infectious Diseases should be dissevered from any Relation with Pauperism," will be adopted sooner or later. Meanwhile, the Asylums Board, a poor law authority in theory, admittance to its hospitals being obtainable only through poor law agencies, has become a sanitary authority in practice, and will become a sanitary authority in law should occasion unhappily arise for putting into force certain provisions of the Diseases Prevention (Metropolis) Act, 1883, a measure to which we are indebted for the valuable concession just alluded to.

It is a curious feature in our sanitary legislation that, while the most complete provision has been made for preventing the spread of animal infectious diseases—by notification of illness, by isolation of the sick, and by disinfection rigidly carried out—no such provision has been made against the spread of human infectious diseases. We have no power to enforce notification; isolation is almost impossible, except by voluntary removal to hospitals, whilst disinfection is efficient—so far as it is efficient—only because sanitary officials, with the consent of sanitary authorities, but without legal obligation, have largely taken the matter into their own hands. The success of "local authorities" in "stamping out" animal infectious diseases is greater than any we can claim in our incessant warfare against human infectious diseases—partly, no doubt, because they possess the power of slaughtering the sick; experience, however, justifies the conviction that if the necessary powers of dealing with such diseases were conferred on sanitary authorities, a far larger measure of success than heretofore, and that measure is not inconsiderable, might be attained. But there is little reason to anticipate the grant of such powers until a strong central sanitary authority shall have been created, by which the action of the several local sanitary authorities may be combined for the common good.

Even under existing legislation a central authority would be able to confer public benefits not to be expected so long as sanitary power remains scattered and divided. In illustration I would refer to one of the most important wants of the age—healthy dwellings for the poor. The necessity is paramount, but can never, in any large degree, be met through the operation of Artisans' and Labourers'

Dwellings Acts. No! It is to a more humble and more practicable machinery we must look, that, to wit, provided by the 35th section of the Sanitary Act, 1866, which empowers sanitary authorities, with the sanction of the Local Government Board, to make regulations as to "lodging-houses," other than common lodging-houses. This subject has, on more than one occasion, received earnest consideration at the hands of the Society, which, not many years ago, prepared a code of "regulations" for the guidance of sanitary authorities, few of which, however, have applied for the necessary powers; and yet there is evidence that where the provisions of the section have been honestly carried out, excellent results have been obtained. Nothing short of the exercise of such powers will suffice to compel owners of tenement houses, and occupiers of lodging-houses, to do their duty by their unfortunate lodgers; and it is beyond hope that the Act will ever be put into operation in all parts of the Metropolis, and efficiently carried out under uniform bye-laws, settling, among other things, the proper amount of cubic space to be allowed, until we have a central sanitary authority superior to all local and interested considerations.*

Baths and washhouses, public urinals and water-closets for both sexes, mortuaries and disinfecting chambers, can only be mentioned by name, in passing, as instances of sanitary requirements still most inadequately supplied after more than a quarter of a century of divided sanitary government. A central authority affords the only prospect of adequate provision of such institutions, suitably located for general use, irrespective of local boundaries.

An unconscious striving after unity in sanitary administration has occasionally led to something like conflict of jurisdiction, the result of piece-meal legislation. As instances of this I would refer to the Slaughter-houses (Metropolis) Act, 1874, dealing with offensive trades, and to section 34 of the Contagious Diseases (Animals) Act, 1878, dealing with cowsheds, dairies, and milk shops. Under these enactments the Metropolitan Board of Works is the "local authority" for the Metropolis, the City only excepted. No exception could have been taken to the action of the Legislature in conferring this position

* In December, following the delivery of this address, the Local Government Board, exercising powers conferred by section 47 of the Sanitary Laws Amendment Act, 1874, declared the enactment contained in section 35 of the Sanitary Act, 1866, to be in force in every district of the Metropolis, the authority of which had not previously made application to the Board for powers to enable it to make regulations: the Board at the same time issued "Suggestions for Regulations," but there is no legal obligation on the Sanitary Authorities to make or to enforce regulations.

on the Board, had its duties been limited to the preparation of bye-laws and general supervision, and had the duty of inspection been specifically entrusted to the sanitary authorities. Nevertheless, all drawbacks notwithstanding, that considerable benefit has accrued from the legislation in question is indisputable; it is a fruit of unity resulting from practical co-operation between the central Board, having legal jurisdiction but no proper sanitary staff, and the local Boards without defined jurisdiction, but possessing an ample staff of sanitary officials. Had the duty of framing bye-laws been committed to the vestries, &c., we might have had as many codes as "local authorities," despite the labours of the Society to promote unity, labours of which the Metropolitan Board made such good use in framing their bye-laws under both the Acts.

The exigencies of time forbid further illustrations of the need of unity in Metropolitan sanitary administration: I pass on, therefore, to consider—

2. How such Unity may be brought about?

Two courses are open: the existing sanitary authorities may be swept away, and an entirely new authority created to rule over an undivided London; or, the present local machinery being retained, a central board may be established to take charge of all great matters affecting the Metropolis as a whole, to lay down the principles on which sanitary administration should be carried out, by framing bye-laws, &c., and, generally, to exercise a supervisory control over the work entrusted by the Local Management Acts to the vestries and district boards: the central board would, so to say, be legislative in its functions, the local boards executive, and thus substantial unity might be attained with a minimum of change.

I have no hesitation in expressing my individual preference for the second of these courses, and I suppose that the manner in which some such a scheme may be brought into practical working is a question that may be expected, ere long, to engage the attention of the Legislature, it being difficult to believe that a system which has worked so well and conferred so many benefits on the Metropolis should be cast aside in order to give trial to a new, a vast, and a doubtful experiment such as that involved in the adoption of the first course.

Assuming for the occasion that the more conservative course will be adopted in any proposed legislation, let us briefly glance at the constitution, the jurisdiction, and the duties, so far as they affect the subject, of the several bodies out of which the new machinery of

local government will be evolved. They are forty (or, if we include the Metropolitan Asylums' Board, forty-one) in number—viz., the Corporation, the Metropolitan Board of Works, twenty-three vestries, and fifteen District Boards of Works.

The Corporation, a very ancient and still unreformed body, consists of 232 members, of whom 26 are Aldermen, representing as many wards, and 206 are Common Councillors, representing twenty-five wards. The Aldermen are elected for life—some of them by constituencies so insignificant in point of numbers, that less than 200 votes have sufficed at a contested election to determine the choice of a future Lord Mayor. The Common Councillors are elected yearly. The City over which this dignified assembly bears rule comprises an area of about one square mile (actually 668 acres) it has a declining resident population of some 50,000, half of what it was 200 years ago, occupying, to a large extent as office caretakers, some 6,500 houses, and it has a rateable value exceeding £3,500,000. The sanitary administration is in the hands of a statutory committee of the Corporation, the “Commission of Sewers,” which consists of ninety-five members—viz., Lord Mayor, Recorder, Common Sergeant, the three representatives of the City at the Metropolitan Board of Works, six Aldermen and eighty-three Common Councillors—and discharges duties similar to those of the vestries, &c. Like the vestries, the Commission retains the services of a medical officer of health and a staff of sanitary inspectors.

The Metropolitan Board of Works comes next after the Corporation in order of importance, but for an obvious reason I shall first refer to the vestries and district boards. In the constitution of these bodies the limits of parishes—one of the most ancient of our institutions—were respected. Outside the City there are seventy-eight parishes: twenty-three of these are self-governing centres, the governing body being the vestry, while other fifty-five are grouped in numbers varying from two to eight to constitute fifteen district boards. Vestrymen are elected by the ratepayers; members of a Board by the constituent vestries of the district. The maximum number of members in these bodies is 120, the total for the metropolis being about 2,500. One-third of the members go out of office annually in rotation, all being elected for a period of three years. The importance of the several parishes and districts, estimated by acreage, mileage of streets, population, rateable value, &c., varies considerably. Thus, while St. James's, Westminster, has an area of 162 acres only, Wandsworth contains

11,488 : the latter district has over one hundred miles of streets, while in St. Martin's-in-the-Fields the streets extend for eight miles only. The rateable value ranges from about £200,000 in St. George's-in-the-East to £1,700,000 in Kensington : the population from 29,000 in St. James's, Westminster, to something like 300,000 in Islington.

The duties of these bodies are numerous and important. Under the Metropolis Management Act, 1855, they are responsible for the paving, watering, cleansing and lighting of streets, for local drainage and "dusting"; whilst under Nuisance Removal, Sanitary, and Diseases Prevention Acts, they discharge multifarious duties, including the removal of nuisances and the care of the public health, each employing for these purposes a staff, comprising at least one medical officer of health and one or more inspectors of nuisances.

It is no part of my duty this evening to pose as the apologist of metropolitan local government, but it would be unjust not to refer to a fact, to which universal testimony bears witness, that whatever the shortcomings of the system, the labours of these much-abused bodies have, in little more than a quarter of a century, made London to be the best paved, the cleanest, the best lighted, the best drained, and (may we not say?) the healthiest great city in the world.

The Metropolitan Board of Works, like the vestries and district boards, is a creation of the Metropolis Management Act, an Act passed to make provision "for the better local management of the metropolis in respect of the sewerage and drainage and the paving, cleansing, lighting, and improvement thereof." In addition to a paid chairman, it consists of forty-five members who are not merely the delegates or deputies of the vestries and district boards, by whom they are elected, but are, I imagine, with three exceptions, themselves members of those bodies ; so that the Board might be described as the quintessence of vestrydom. Probably few rate-payers, even among the severest critics of local management—those who extol the greater light at the expense of the lesser lights—are acquainted with this relation between the Board and the vestries.

The members are elected for three years, one-third retiring every year. The Common Council of the City sends three representatives; six of the vestries send two each, and seventeen other vestries send one each, the remaining thirteen members being elected by the

fifteen district boards. The Board has jurisdiction for certain purposes over the whole metropolis, an area of 75,000 acres, and has been entrusted with the carrying out of about one hundred Acts of Parliament. Some of these Acts relate to great engineering works, like the main drainage and Thames Embankment schemes, involving the outlay of millions; others are of comparatively small importance: speaking generally, however, all have this feature in common, that they relate to matters affecting London as a whole, and require for their due execution an undivided authority.

Some of the work done by the Board, the main drainage for instance, is of the utmost value from a sanitary point of view, and yet the Board is only indirectly, and by accident, as it were, possessed of sanitary authority. Under the provisions of the Artisans' and Labourers' Dwellings Improvement Acts only, it has power to appoint a medical officer or officers of health, but although in respect to some of the duties it has been called upon to perform, skilled medical advice would have been of value, no such appointment has ever been made. Nevertheless, it is admitted on all hands that the Board has done its work well, a fact creditable alike to itself and to its constituents.

The Metropolitan Asylums' Board, which, as already stated, has, by force of circumstances, developed into a sanitary authority of the first importance, consists of sixty members, of whom one-fourth are nominated by the Local Government Board, the remaining three-fourths being elected by the thirty Boards of Guardians. In mode of election, therefore, the Board presents an analogy with the Metropolitan Board of Works, the managers being chosen by the representatives of the ratepayers; a system which, in practice, has been found to work well, seeing that the guardians, like the vestries, have almost invariably deputed their best men, the appointment in either case, moreover, being regarded as an honourable distinction. What I would call the sanitary work of the managers—for they have multifarious duties strictly appertaining to the relief of different classes of paupers—has been well done; and notwithstanding occasional complaints on the score of excessive expenditure, there can be no doubt that they have rendered great services to the metropolis from a public health point of view.

The scheme of metropolitan government, for which I have already expressed preference, contemplates the retention of the vestries and district boards in a local and executive capacity, under

such control as may be necessary to secure unity and uniformity. It is with the constitution of this central authority, therefore, that we have now to deal; and I would say, *in limine*, that the continued separate existence of the Corporation and the Metropolitan Board appears to be incompatible with the formation of such an authority; unless, indeed, the Corporation should be permitted, under some reformed constitution, to maintain its rule in the City, leaving the rest of the field clear for the Metropolitan Board. Otherwise the question arises, shall the Corporation, endowed with enlarged jurisdiction and the necessary powers, become in fact as in name the Corporation of London? Or, shall the Metropolitan Board of Works, with similarly enlarged powers, and under whatever name, extend its sway over the City? Prescription, historical prestige, and other like considerations, plead for the Corporation: the success that has attended the work of the Metropolitan Board suggests strong arguments in its favour. Whichever body may ultimately be chosen, I venture to express the opinion that if the members of the central authority could be chosen, like the members of the Board at the present time, by and from the vestries, themselves immediately representing the ratepayers, London would have a better prospect of being well and wisely governed than if the members should be elected directly by an appeal to popular suffrages. Should the plan of direct election by the ratepayers find favour, we can but hope that one of the most honourable distinctions of the present system of local government, its absolutely non-political character, may be preserved: it would be a calamity indeed should metropolitan government ever become the subject of political warfare.

However constituted, the new authority should take over, among other duties, those now discharged by the Asylums Board with regard to hospital provision, &c., together with the hospitals and ambulances; it should have power to acquire on equitable terms the property of the water companies; it should be the vaccination authority; and, in addition to medical and other officers concerned with public vaccination, it might be clothed with powers to appoint coroners and registrars of births, deaths, &c. The provision or control of cemeteries might not unreasonably be one of its functions.

For the discharge of the multifarious duties that would devolve upon the central authority perhaps you imagine I contemplate the formation of a Board which by sheer force of numbers would be

unwieldy? Not so; I am of opinion that the new authority need not be larger than the Corporation, which, as before stated, consists of 232 members. This number should prove ample, if we may judge from the amount of work got through by the Metropolitan Board with forty-six members, by the School Board with fifty, and by the managers of the Asylums Board with sixty.

Officers in plenty are ready to hand, and only one entirely new Department would have to be created—one, however, of the highest importance and interest to us—that, namely, of Public Health. A principal medical officer of health—*primus inter pares*—should take charge of the City, which would naturally be the seat of government. To the office over which he presided, information in respect of the occurrence of specified infectious diseases should be forwarded by local medical officers daily, and these in return should be made acquainted with whatever it behoved them to know in regard to the occurrence of such diseases beyond, but adjacent to, their own districts. In like manner periodical statistical returns, on a uniform system, should be forwarded to the departmental office, there to be collated and tabulated for general use. An annual report by each local medical officer of health, based on some agreed plan, should be prepared, printed, and sent at a specified time to the central office; on the foundation of these local reports, the principal medical officer would be charged with the duty of preparing a report relating to the metropolis as a whole.

In this way, and assuming "compulsory notification" to exist, we should be kept informed from time to time of the state of the public health; we should be made cognisant of the very beginning of an epidemic, and thus we might hope for much success in efforts for "checking or preventing the spread of infectious diseases," which, as you are aware, is one of the principal duties assigned to us by the Act to which we owe our official position.

Having now in imagination got our Central Authority and so brought about unity in sanitary administration, let us consider—

3. *The probable benefits to be expected from such unity being attained.*

In the forefront I would place consolidation of sanitary laws, a measure which we believe only awaits that reform in local government with which London has been so long threatened or tantalised. With consolidation we may reasonably anticipate such additional powers being conferred as experience has proved to be necessary for success in the contest with preventable diseases.

Among the chief of these we may class "compulsory notification," without which the most diligent efforts to control and limit epidemic outbreaks can never be more than partially successful. The time has passed for insisting on the necessity of such a measure, the principle having been accepted by the profession, by the Government, as represented by the President of the Local Government Board, and even by Parliament itself. With notification I would bracket provision of hospitals, and I am not sure, having regard to relative importance, whether I ought not to have placed this first; for hospitals almost infallibly lead to voluntary notification, while even compulsory notification without hospitals is robbed of a great part of its value. Happily we have, or soon shall have, in the Asylum Board's hospitals, all the accommodation likely to be required for small-pox and "fever," whether in the acute or the convalescent stage, and in due course, I doubt not, the hospitals will come under the control of the central sanitary authority. For one year, moreover, under Sect. 7 of the Diseases Prevention (Metropolis) Act, 1883, even the nominal stigma of pauperism will not attach to persons admitted into the hospitals, and the Society might well make an effort in the coming session to get the provisions of this section made permanent. The opportunity is too favourable to be let slip, seeing that the President of the Local Government Board is with us, he having, in 1878, and again in 1879, introduced a measure "to remove disqualification by medical relief for infectious diseases." By every inducement the sick should be encouraged to enter the hospitals, often the only means of securing isolation and safe-guarding the public. No charge should be made unless special accommodation were desired. For the most part the boards of guardians have acted judiciously in not attempting to obtain payment, and the Asylums Board have ever kept open doors for all comers sent in conformity with the requirements of the Orders of the Local Government Board; so all we need now is that the sanction of law should be accorded to established practice, a course for which we can plead the high authority of the Hospitals Commission, who have said that "it is desirable in the public interest to attract to these hospitals, even by the bribe of gratuitous treatment, all who will go thither."

Persons suffering from a "dangerously infectious disease," and being "without proper lodging or accommodation which would enable them to be properly isolated, so as to prevent the spread of disease to other inmates of the same house, and to be properly

treated," should invariably be removed to hospital under justice's order, as recommended by the Conference of Sanitary Authorities held in 1881; and the 26th section of the Sanitary Act, 1866, should be so altered as to confer the necessary powers of removal.

Whenever the duties of the Asylums Board shall have been transferred to a central sanitary authority, no part of the machinery organised by the managers will be more appreciated than the ambulance service. You are aware that at every hospital a station has been, or is about to be, provided. The facility, the comfort, the safety, and the rapidity with which the sick are now transferred from their homes to the hospitals, leave nothing to be desired. An ambulance steamer, moreover, has been specially constructed for conveying patients from a river-side wharf to the hospital ships at Long Reach, where the managers have obtained land for various purposes within easy reach of an estate at Darenth, on which they purpose to build a large hospital for convalescents.

So much with regard to the safeguards, *qua* infectious disease, which we already possess, or hope to obtain through the agency of the new Central Board, and as the result of unity in sanitary administration.

I pass on now to offer a few illustrations of the probable results of unity in regard to other branches of sanitary administration; and first with regard to the water supply. Beyond doubt this should be in the hands of a central authority, and until we have such an authority, the companies will probably keep possession; although I note the intention of the Metropolitan Board to submit a scheme to Parliament next session. No scheme can be satisfactory that does not provide for a constant supply of potable water from the purest attainable source.

Baths and washhouses, not scattered haphazard, or placed in merely paying districts, but evenly distributed, should stud the Metropolis as now do the board schools. Increased powers, including those for compulsory purchase of land, are required, and would probably be conferred on a central sanitary authority which recognised the duty of providing baths and washhouses on this plan. Great benefits would be conferred by the provision of a large number of buildings on a modest scale to which the poor could resort for the purpose of washing clothing, &c. The question of public washhouses might, with advantage, be separated from that of public baths.

Mortuaries, in like manner, should be provided, the Metropolis

being treated as a whole, without regard to parochial boundaries. The need of such accommodation is great and pressing, and it is a question whether increased compulsory powers for the removal of the dead—and I would add legislation to secure more speedy burial—might not properly be sought by the central sanitary authority. Disinfecting chambers, for the free use of all classes, should be provided on the same principle of distribution, and men should be specially trained for the duty of house disinfection after the occurrence of dangerously infectious diseases.

Public urinals and water-closets, for both sexes, are imperatively needed. It is not so much that the existing authorities are unwilling to make the necessary provision, for which they possess ample powers, as that the difficulty of obtaining sites has been found insuperable, owing to the weight of local opposition. Time and usage would gradually overcome this difficulty, once a certain number had been provided by a central authority acting for the whole Metropolis and uninfluenced by sentimental objections.

I have already referred to the anomalous position occupied by the Metropolitan Board of Works with respect to slaughter-houses and other “offensive trades,” and to dairies, cowsheds, &c. A central authority, content to exercise a general supervision, and with the power of framing bye-laws, would naturally delegate the duty of inspection to the local sanitary authorities. As regards slaughter-houses, the authority would hasten the inevitable time when they must be superseded by abattoirs. Already, under the Slaughter-houses Act, 1874—that is, in nine years—the number of private slaughter-houses has been reduced from over 1,400 to something like 850, and the reduction goes on year by year by the extinction of the licenses of the worst places, and this, obviously, without any public inconvenience. Many butchers renew their licenses rather with a view to keep up the value of their premises than on account of any use they make of their slaughter-houses. Every year the dead meat trade increases in importance, and, owing to increased facilities, and the use of refrigerating vans, meat is brought from great distances.

Milk, like meat, comes from country districts in ever-increasing quantities, and from greater distances, less and less being produced in and near town. The cowsheds have not undergone the same diminution in numbers as the slaughter-houses, but fewer cows are kept, if only because of the increased cubic space required. Under the provisions of the Contagious Diseases (Animals) Act, 1878, as you are aware, the carrying out of the “Dairies, Cowsheds, and Milk-

shops Order of 1879" was intrusted to bodies having no acquaintance with sanitary work, the result being that the main provisions of the Order were almost entirely neglected. Thanks to the efforts of this Society, among others, the Government, conscious of the mistake made in 1878, brought in a Bill in the last session to place the cowsheds, dairies, &c., under the sanitary authorities everywhere, save in London. Pressure of business, fortunately, compelled the withdrawal of the measure, but as it is sure to be introduced again next session, a strong effort should be made to secure their rightful position for the sanitary authorities. Whether we succeed or whether we fail in this effort, it will be a good day for London when the sanitary supervision of country dairies and cowsheds shall have been handed over to the sanitary authorities, to whom we may reasonably look for protection against a terrible danger, such as that so well illustrated by our Hon. Secretary Mr. Shirley F. Murphy, in a recent report on an endemic of enteric fever in St. Pancras.

Before passing from questions relating to food, I may be allowed to congratulate the Society on the partial success of their efforts to bring bakehouses under efficient supervision. The Factory and Workshop Act, 1883, *quâ* bakehouses, is a very imperfect measure; still it is something to have obtained for the sanitary authorities the power of inspection—a power of which sanitary officials, I doubt not, will make good use. For the proper regulation of bakehouses, an Act enabling the central sanitary authority to frame stringent bye-laws is necessary: the duty of inspection and of enforcing the bye-laws should of course be entrusted to the local sanitary authorities.

Increased powers of dealing with recurring nuisances are required, and would probably be conferred on a central sanitary authority. By means of bye-laws such an authority should be able to deal effectually with the great "refuse" question, which has on more than one occasion engaged the attention of the Society. House refuse, I need hardly say, should be collected daily, and dustbins abolished. The offensive refuse of certain trades—butchers, fish-mongers, poulters, greengrocers, &c.—should also be collected daily, early in the morning, in suitable vehicles, and at the reasonable cost of the producer. The refuse of stables and cowsheds should be collected frequently, if not daily, with like precautions, and on the same conditions. So far as practicable refuse matters should be utilised; but to a considerable extent, especially in districts remote from railways or canals, it will be necessary to provide for the disposal of such matters by fire in suitable apparatus.

Did time permit, it would be easy to enlarge still further on the benefits that may be expected to result from unity in sanitary administration. I might descant on the necessity of a new Building Act, on sewer ventilation, on the disposal of sewage, and on many another subject that will readily occur to your minds, but I feel that I have already detained you too long, and so will bring my discourse to an end. In so doing, let me repeat emphatically that in order to good government, I see no necessity for material alteration in the constitution, or in the work of the vestries and district boards. On the contrary, I affirm that they, or some practically identical well-organised authorities under efficient control, will be found necessary for local administrative purposes, whatever the constitution of the new central authority. London is not merely a great city; it is a province of houses, half a million in number; its population of nearly four millions is greater than that of some kingdoms, the mere yearly increase being sixty thousand souls; and its area, exceeding one hundred and twenty square miles, is so vast that any attempt to govern it from one centre without local aid is but too likely to end in costly and disastrous failure.

"The Water Supply of Troops in India." By Edward Nicholson, S.S.C. Camb., F.C.S., F.I.C., Brigade Surgeon (Retired List) Army Medical Department.

Foreign as my subject may appear to the ordinary topics of discussion in this Society, I yet hope that it may offer points of interest, not only as regards India, but for the light which may be reflected from Indian experience on some sides of the subject of water in England. It is well that we should turn sometimes from the high civilisation to which we are accustomed in this capital, and contemplate more primitive modes of life; and in no way is this so easily done as by looking at life in India. There an Englishman may pass his active life in different parts of the country without ever seeing a pump, a water pipe, or any of those appliances of town-sanitation to which we are accustomed, without ever seeing any fire-place but the earth, or the floor of his own kitchen. The application of sanitary principles are there modified by the power of the sun, the general cheapness of land and of native labour, and the costliness of European machinery

and labour. And one more factor, a consequence of the cheapness of land and labour—the intense poverty of the country.

The Indian army is divided into European and native. In southern India, the part with which I am familiar, the native army is never lodged in barracks. The sepoys live in lines of huts, with mud walls and tiled roofs, each very small, but with a little walled courtyard in front. There the sepoys live with their families on their small pay; sweepers come round the huts to clean out the midden, the women go to the well for water. If a sepoy is sick he goes to hospital, where he is accommodated with a trestle bedstead and medical treatment; his family bring him his food, his comrades give him such nursing as he may require. This is all he desires.

The European troops are mostly lodged in barracks of simple construction spread over a large space, and in which sanitation is effected by simple means. Shelter from the sun and free ventilation are the principal objects of the buildings. There are no sewers; all drains are above ground, only when so deep as to be dangerous are they covered over—generally by slabs of stone. All night-soil and refuse is removed by hand; the dry-earth system is generally used, though in practice it is not perfect.

The scavenging, as well as the water supply, is effected by native labour; the Indian sweepers and watermen, together with the cooks and the washermen, forming an indispensable corps of auxiliaries who set the soldiers of our small army free for purely military duties.

Water is generally drawn from open wells within the barrack grounds, or as near them as possible. As the whole land belongs to government in the cantonments, where troops are stationed, there is never any difficulty about the appropriation of land which yields good water. A well of ten to twenty feet in diameter is sunk, or as many wells as are required by the quantity of water to be supplied and the extent of the barracks. Sometimes a tank or large pond is used, though such a source is not often directly drawn on; the water is generally obtained abundantly from a well sunk in the ground above or beside the tank. The Indian tank is generally a sheet of water retained by a dam or *bund* built across the line of drainage. In many parts the valleys are thus dammed across at intervals of about two miles; the chain of tanks so formed retaining water for the irrigation of crops during the

dry season. A well sunk below the bund of one of these tanks will tap the water-sheet of the next tank below, and therefore the water will be at a much lower level, but wells sunk at the side or above the tank yield water at or about its level.

The water of these tanks is generally soft; if it be free of water-plants—either by yearly exhaustion or by their extirpation—the water will almost certainly be turbid with fine clay that weeks of repose will not entirely remove. If the tank contain luxuriant vegetation the water will be clear; it will contain much more organic matter in solution, having generally a fresh smell and taste. Of course, the quality of water depends much on the conservancy of the tank and gathering ground. Should there be much pollution of the water, the vegetation thus encouraged will absorb it, and only the mineral traces of the pollution remain to show its former existence. There are, of course, some tanks where annual exhaustion destroys the vegetation, and the influence of sun and air are insufficient to cope with the pollution from bathing and washing garments. Especially to be noted is the pollution by the local ablutions customary with all Indians after their usual morning digestive walk—a walk which is often so near the tank that infection with the germs of disease may easily occur.

But such sources of water supply are not used by our troops, whose barracks are always provided with wells, and I have never known of any pollution of these. The ground is paved for a few feet around so that there shall be no danger of immediate percolation of spilled water into the well.

The quality of the water in these wells is very various. It is generally free from all suspicion of pollution from drains; dust and dirt certainly find their way in, to some extent, during the operations of drawing water, hence the use of filters in all barracks.

Each company of about 80 men is permanently provided with about four watermen. In the northern parts of India these men (*bhistis*) carry the water on their backs, in leathern bags called *mussuks*. In Southern India the water is carried in larger bags, called *pukhals*; a pair of these, holding 30 to 35 gallons, being carried by a bullock. The waterman, hence called a *pukhally*, goes to the well with his bullock, and, standing on the parapet, throws his leathern bucket in, hauls it up full of water and gradually fills the *pukhals*. Then the bullock walks slowly away with his heavy load, goes in and out by the numerous cookhouses,

bath rooms and barrack filters ; the waterman lets out water by untying a primitive spout, until the load is exhausted, and so he toils nearly all day. Sometimes he carries the water in earthen pots ; sometimes he uses a pulley to raise water by, but he must always have his bullock ready for service in case the troops have to move. His pay is about 20s. to 24s. a month, finding and feeding his bullock, as well as keeping himself.

The storage of water in barracks is simple. The bath room is an outhouse with open-work walls instead of windows, containing a long basin-stand, a grating and some tubs (half beer casks). Every soldier brings his own steel basin and dips into a tub, either to wash at the basin-stand or to dash water over himself for a full bath. Nothing can be simpler or more efficient.

Where there is a good supply of water, swimming baths are usually provided for the soldiers. The bath is filled and changed by the work of a pair of bullocks, which haul water from the well in a large leather bag, hauled by a rope over a pulley. Sometimes the more perfect system of a pair of water-bags is used with advantage, one coming up while the other descends, the rope being coiled round a large drum.

This and other ingenious Indian machines are frequently used for raising water when the well is at some distance from barracks. The water then flows by masonry channels to a receptacle, whence the waterman can easily supply the barracks. Only at a few—some three or four—cantonments is steam-power used.

It may be said, “ Why not have pumps everywhere distributing the water by pipes to the barracks ? ” I regret to say that pumps do not usually work well in India. It must be remembered that a pump requires repairs not unfrequently, and persons competent to this task are not usually found in Indian cantonments. Pumps have been tried often, and not with general success. Searching the records and traditions of an old established hospital at St. Thomas’s Mount, near Madras, I found that pumps revolved in a cycle of about ten years. I do not mean that a pump lasted ten years, but that a pump was set up about every ten years. Some medical officer in charge would be struck with the desirability of a pump to the hospital well, and he would accordingly open correspondence on the subject. After the lapse of two or three years, and many reports by Inspecting Officers of different sorts, the pump would at last be sanctioned by the Governor in Council. The Public Works Department would accordingly, in due course, pro-

cure a pump from England and fix it up. The fifth year of the cycle would have arrived by this time, and pass in correspondence between the Medical Officer (not the same one who had first moved) and the Public Works Department, and in efforts to make the pump work. The sixth year would see the removal of the failure, and peace would reign in the water supply during the remaining years, when the same idea would strike another Medical Officer with similar results.

Even in England barrack pumps are so frequently getting out of repair, besides giving a hated *corvée* to the fatigue parties who work them, that I would deprecate their introduction into India for the present. There are admirable mechanical means of raising water in use among the native population, and a sensible adaptation of these to barrack requirements would be sufficient.

As regards the transport of water in bags carried by bullocks—the system is bad—because it is really unsuitable to the line of march or active service—an object which must be kept in view when making arrangements for soldiers. Masonry conduits carry water perfectly, and are built very cheaply, while carriage by water carts is the suitable plan on the line of march whenever the country permits. It is important to keep the water supply of troops as much as possible in harmony with the system usual in the country, and to have an establishment ready for the exigencies of camp life.

I have said that purification of drinking water by filtration is provided for in barracks. Until a very few years ago the apparatus used was the primitive 3-chatty filter—so called because it consisted of three unglazed earthen water-pots, commonly called chatties, placed one over another in a bamboo tripod with three skeleton shelves. Every barrack verandah had at least one of these, so that the soldier had never to go many yards in search of a drink of water. The two upper pots had some small holes punched in their bottom; these were stopped with straw, coir, or rag, so as to allow a dribble of water. The uppermost was generally a reservoir, whence water trickled on to the middle pot, which was half full of sand and charcoal; the water was supposed to be purified by its passage through this medium, and to be stored cool in the receptacle at bottom. Certainly the water was thoroughly cooled, being about the temperature of the dew point, or from 5 to 30 degrees below that of the air. The arrangement was admirable in simplicity, especially in providing for the wants

of the barrack dog and the thievish crow, whose favourite perch was on the filter stand ; and if the waterman only filled the bottom receptacle, thus sparing the water its passage through the more or less dirty media above, the water was not made worse. The same may doubtless be said of many domestic filters nearer home.

This filter was superseded some ten years ago by a pattern introduced by Dr. F. N. Macnamara, professor of chemistry in the Calcutta Medical College. It was a very large Danchell's filter, with the addition of a few inches of sand. The water passed up the sand and bone charcoal, then downwards by the siphon, and came out at the stopcock as required. There were many flaws in its construction, and it was the despair of the commissariat department which had to keep it in repair. The water, strained through the bone charcoal, and the dirt of many weeks was found to contain much animal life, attributable to the phosphate of lime, and it was not cool.

I was struck with the simplicity of the old 3-chatty filter, and thought that if a filter really was necessary, this might be modified so as not to render the water dirtier than before. I took 2 chatties instead of 3. I made the upper close the mouth of the lower, and changed the latter into a jar with a brass stopcock. The upper chatty had a nozzle in the bottom, about an inch diameter and 3 inches long. This nozzle held a piece of sponge, which acted as a very efficient filtering medium, capable of being washed daily. The whole was placed on a brick and mortar stand in the barrack verandah. The unglazed pots could be renewed every six months, or as often as they ceased to cool the water ; the brass nozzle being re-fixed with some cement.

The commissariat department was very anxious to adopt this pattern, so simple and cheap, and the soldiers esteemed it highly, but government could not be moved from the pattern recommended by the professor of chemistry at Calcutta, and so the matter dropped.

However dubious I may be regarding the advantages of filters in barracks, yet there must be some storage of drinking water in unglazed pottery or other vessels allowing the water to cool from a temperature of 100° , 110° or more, down to near the dew-point. I prefer attention to the source and carriage of the water, rather than filtration. But if there be any real doubt about the wholesomeness of water or fear of pollution with organic poisons, I should certainly advocate boiling it. When it has cooled it can be passed through the sponge filter to aerate it and keep it fresh.

The diseases attributed to bad water in India are many, but the actual cases proved are very few. What are these diseases as far as we know at present? I put aside *Goître*, for the evidence, though pointing to water, is very unsatisfactory. Southern India affords every variety of water containing mineral matters in large quantity:—lime and magnesia in every form, sulphates, nitrates, silicates; yet endemic goître appears to be unknown. Cases of the disease are most rare. It seems really confined to the valleys of the Himalaya mountains.

Calculus again is most rare in southern India, while northern India has its Norfolk in the province of Aoudh, in the north-west provinces.

Passing to the diseases more clearly attributable to water:—

Guinea-worm is endemic in a few cantonments of southern India, attacking people who bathe in certain tanks, and appearing after an incubation of about a year. I have never seen it.

Lumbricoid ascarides are very common throughout India; they may fairly be attributed to the use of impure surface waters; they are favoured by vegetable diet and by insufficiency of salt among the poor.

Elephantiasis is generally ascribed to impure drinking water. At Cochin, where it is very prevalent, the European residents have drinking water brought by boat from a place some miles distant, in order to avoid the dreaded disease. It would be simpler to drink none but boiled water. It is much to be regretted that no researches have been made on this disease in India. The subject is, however, beginning to receive attention.

Dysentery and *Diarrhœa* are ascribed to impure water. With regard to the former, the evidence is very doubtful. Diarrhœa may doubtless be caused by some animal poison with which the water may have become affected. I have never seen brackish waters produce it.

Malarial Fevers are asserted, on good authority, to be caused by drinking water, but though cases are alleged where a particular spring, especially in hilly districts, has the power of producing fever, yet I have never known any crucial experiment made. Water from rice fields has often been accused of causing ague. This I think rather a sequence from the idea that rice fields produce malaria—which is not the fact; malaria may reign in rice fields, in marshes, on the banks of rivers, or on the driest rocky ground. But as a fact, the rice districts of India are rather

freer from ague than the rest of the country. Troops arriving from the dry plains of Poona or Nagpore, or the sands of Kurrachee, hardly a man among them free from ague, lose it entirely after a few months in the rice fields of Malabar, or at Rangoon, in the steamy delta of the Irrawaddy.

Enteric fever has of late years become an alarming cause of disease among our troops in India. I need hardly remind you of the controversy which has taken place on the nature of this Indian enteric fever. Its existence has been denied—at least it has been said that although the fever may have the symptoms and show the *post mortem* lesions characteristic of enteric fever, yet the cause of infection must be shown if it is to be considered identical with the infectious enteric fever of Europe. This view, enforced by authority, had the effect of suppressing enteric fever for a time; but the pressure being removed, enteric fever persists. The demonstration of the cause of the fever in each case, not so easy in Europe, is very difficult in India—all the more so that the diseases of the native population are very little studied. In the vast majority of cases the Indians have no European medical attendance, there is consequently no efficient registration of fatal diseases; *post mortem* examinations are never made except in criminal investigations, or on the bodies of prisoners dying in jail. Consequently there is a general opinion that the Indians are not liable to enteric fever. If this were the fact, it would almost of necessity follow that enteric fever is generated *de novo* in India among Europeans, but not among the people of the country—which is very unlikely. But it is proved that enteric fever does occur in natives of India; it is certain that a large proportion of their mortality is from fevers, and that 99 out of 100 have no medical attendance, or what we should consider such. Add to these facts that soldiers, especially the recent arrivals, are addicted to roaming about those bazaars which offer drink and prostitution; that the inhabitants of these bazaars live in a peculiarly dirty way; that the well which supplies them with water is often only a few yards from a foul privy; that roaming in the hot sun requires some water to drink. Altogether there is no difficulty in accounting for enteric fever among our soldiers. That the particular source cannot be traced is not wonderful; the soldiers are very reticent as regards their haunts in the bazaar; for instance, no soldier ever remembers the house at which he has contracted the venereal disease which has brought

him to hospital. His answer is always evasive ; either it was not in a house at all, or at a house which the men have arranged as always to be accused.

Cholera. The propagation of cholera by drinking water is generally accepted in India. And although I have never been able to trace a case to this cause (cases are comparatively few in Southern India), yet I have seen so many instances of the manner in which the disease could spread by pollution of the water supply, especially on the line of march, that the theory of propagation by drinking water accounts in my mind for many outbreaks of cholera.

Amongst the diseases I have mentioned as attributable more or less reasonably to impure water, it will be observed that none but those caused by parasitic animals are likely to be prevented by the most perfect filtration of water. And from the prevalence of nematode and turbellarian worms in water purified by Dr. Macnamara's Danchell filter, there seems little probability of this official filter preventing the passage of the ova of parasitic worms. There seems, then, not to be the slightest value to be attached to filtration of water in barracks, except so far as it preserves the form of purifying water from accidental dirt. Boiling the water would, on the other hand, destroy germs of all the diseases communicable by drinking water.

Returning to the question of cholera, I would observe that the mortality from it is largely connected with travelling by road ; and that the facility with which the railway carries Indians at low fares appears to have had a material effect in checking the epidemic form of the disease. Troops marching by road on the periodical change of garrison were formerly very liable to cholera, and the practice has arisen of moving them by railway whenever possible. This plan has its drawbacks, and the military authorities became uneasy at the loss of practice in camp life which resulted. To mitigate the danger of marching by road, Sir Frederick Haines, late commander-in-chief of the Madras Army, very logically thought that if filters were necessary in barracks for the purification of water, the quality of which was well known and generally guaranteed, they must be far more important on the line of march when the soldier has to drink different water daily, each supply being of unknown quality. He invited proposals for a filter-cart, and a number of officers sent in their plans. There was only one of these which showed any

practical knowledge. It came from Colonel Hawkes, of well-known reputation as a commissariat officer, who wrote "the problem is one of no ordinary difficulty. The term filtering is generally used in a very indefinite sense, and many who write on the subject appear to have the crudest notions as to what they propose to themselves when recommending patterns of filters."

None of these propositions being suitable, I was instructed to devise a filter-cart on the principles which appeared to me most likely to be successful. Having done so, I was ordered at once to build six carts, and march with them to Madras (about 220 miles) in company with a regiment which was under orders thither. In less than two months the filter-carts were constructed (with such materials as were procurable at Bangalore) and the march began. The road was noted for cholera, and had been abandoned many years before on that account; the season was late for marching. But the result was most successful; there was scarcely a case of any illness. How much of this result was due to my filters? I fancy but little. But it was greatly due to the water supply by carts instead of by the old puckally bullock system, and to the personal care which I gave to the sources of water supply. Every day I saw instances of how disease might have been produced had I not been relieved from all medical duties for the special care of the water.

I have described the water supply in barracks. We will suppose a regiment has made its first march to a fair camping ground, some ten or twelve miles out of cantonment. Evening has come, the tents will be struck at two in the morning, and at half-past two the regiment will begin a long march to the next camping ground, some fourteen miles distant, expecting to arrive there between seven and eight. Coffee will be provided about half way. The quartermaster has gone on ahead to mark out the next camp, where he will not arrive until dark; the commissariat party, with its bakery establishment, its carts of beer and rum, and its sepoy guard has also marched off, so have the cooks and the cart of cooking utensils; there are at least fifty native auxiliaries thus gone on to sleep at the next camping ground. The watermen of the regiment have drawn their last load of water and filled the tent-buckets, they go on ahead; most of them drop off along the road at roadside tanks or wells (more often tanks), while some push on to the next camp so as to give their bullocks a little rest and grazing before the next day's work

begins. These bullocks go with empty *pukhals*, for it is evident that they could not march fully laden ; besides, the waterman has generally a family and household goods which will form an ample load for his tired beast. At early morning the column marches ; the night is cool, and the men are not heavily laden, yet the dust raised by so many feet hangs in a heavy cloud on the column, and after a few miles the desire to quench thirst becomes strongly expressed. Hence a shout of welcome as through the darkness appears a puckally bullock overtaken by the head of the column. The halt is sounded ; pannikins are got out, and water is distributed. Where did that water come from ? Who knows ? The waterman appears to have been toiling along the road so as to be overtaken by the column at a convenient place ; but whence came the water ? It came from the roadside pool at which he camped with his family last night. They awoke before dawn ; they performed their ablutions at the waterside, and the puckals were filled just as the sound of the approaching column was heard. Many a native traveller had similarly stopped at that tank ; by daylight the traces would have been seen defiling its banks, showing how easily a shower of rain would bring them down into the water. Even that would not be necessary, because of the custom of local ablutions, so that an act of personal cleanliness has become practically a great danger for public health. A traveller with the taint of cholera on him bathes or washes at a roadside tank ; another traveller passes and drinks this same water.

Let us rejoin the column. The coffee-shop, which should have been half-way, is much further on as there was no water at the proper spot. However the men are refreshed with a pannikin of coffee and a biscuit, and they move on. More puckallies are met and refresh the dusty soldiers. At last the camp is reached ; the men are weary, and much water is drunk from the bags already filled at its well. It is too late now for the medical officer to select the source of water supply ; it has been chosen by the watermen. Perhaps there is no well, only the village tank. Even if the tank have been previously undefiled, the fifty natives who formed the advance party last night have already taken their early morning walk in its direction, and evident traces of them are seen on the banks. A sentry is placed at the cleanest part, often too late, and unless he has a couple of native auxiliaries as "bull dogs" he will be out-manœuvred by the eagerness of the numerous followers

to wash in the tank. Cooks, sweepers, camel-men, bullock-drivers, tent-lascars, the watermen themselves, are all eager to wash—how many loop-holes are there not for the propagation of disease? And this is repeated every day for some weeks.

In the march I made from Bangalore to Madras with the filter carts, I was fortunately able to cope with this source of danger; and by a suitable distribution of carts loaded with filtered water I ensured that no soldier on the march drank any water but that authorised. The carts were able to keep up with the column, and thus water was available at any moment. One cart accompanied the coffee-shop party, and enabled it be to ready at the exact distance ordered.

I may mention the soldiers carry water bottles. In India this is a soda-water bottle covered with leather, but it is not popular, and is so soon emptied that the waterman is an essential auxiliary on a march. The water-carts enabled these bottles to be dispensed with, to the delight of the men.

The result of this march was most satisfactory. Certainly the filters attached to the carts were most effectual in purifying water of often very dirty appearance, but I attach much more importance to the carts themselves. The water was filtered through six inches of compressed sponge, there being provision for frequent cleaning the sponges in any one of the four cylinders at work in each cart. The water was delivered at a minimum rate of 20 gallons an hour, and at that rate passed perfectly clear when the cart was jolting along the road. The unfiltered water was in a 60 gallon cask (of galvanized iron), the filtered water was stored in two tanks below.

The Committee appointed to report on the filter carts approved them highly; several commanding officers of corps about to march expressed a desire for them, and I made some more, which worked most satisfactorily, but the requisite professional support was not given, and as I soon afterwards left India, I suppose there is an end of my work. Want of continuity is the bane of Anglo-Indian life, individual or collective.

If ever I went to work on the subject again I should not recommend filters on the march. I should adopt means of carrying the same apparatus for boiling the water as I should recommend in barracks. Water that is very turbid should be cleared before boiling, by the addition of 7 grains of alum to the gallon. The more turbid the water the more quickly it is cleared by alum.

So far as filtration means separation of coarse suspended

matters, aeration, exposure to the universal purifier, it is good ; it acts in the same way as the flow of a river, or percolation through many feet of aerated soil, oxidising organic matters, and affording favourable opportunities for the destruction of germs of disease, but filters are generally far too quick in action, and do not afford time for the full oxidation necessary. I should be especially sorry to trust to filtration on a small scale, when the water source is suspected of pollution. Boiling the water is done in the case of the tea and coffee (and also beer) which form so large a proportion of a European's daily drink ; there is no reason why it should not be done in the case of drinking water, so as to secure perfect safety with very little trouble.

I must now conclude this sketch of a question which has always received attention in India, but has not yet been worked out in the systematic manner which is necessary. It requires the lights of western science, but it cannot be dissociated from a practical acquaintance with the surroundings of our life in India, with the life of the Indian population.

Surgeon-General Gordon said he had spent twenty-five years in India, some of which were occupied by long marches lasting four months, and covering considerable distances, that he had served during the Indian Mutiny, and yet with all this experience of India, he had never found a case of disease directly traceable to water, always excepting those which were due to parasites. He thought more importance was attached to water as a possible source of disease than it deserved, and explained how all the ordinary marches are specifically laid down, the halting places being chosen with reference to water supply, and an officer appointed to see to the purity of this water ; hence the troops always had pure water. He believed that duck-weed served a useful purpose in oxygenating water and thus purifying it. With reference to fever he thought that the differences between one fever and another were dependent rather upon the individual who suffered than upon the disease itself. Younger soldiers, for instance, would have a tendency to glandular enlargement ; hence their greater tendency to lesion of the bowel.

Dr. Tripe, after referring to the generally accepted opinion that the pollution of tanks by excreta was a common cause of fever, noted that high temperature of climate in India was not attended by the same prevalence of diarrhoea as in London, where this

disease appears as soon as the temperature of water reaches 60° Fahr., and he suggested that the vegetation growing in India might prevent the water from becoming offensive. He commented also on the fact that in districts where water had from 80° to 90° of hardness, calculus was not prevalent. With reference to filters, it was noticeable that spongy iron had not been referred to.

Mr. Scriven, who had had much experience of India, condemned the three-chatty filter. He had frequently found it impossible to trace enteric fever to drinking-water as its source, but he freely accepted the English experience that this disease was usually introduced by the mouth. He had always inquired into the condition of water in all houses where enteric fever occurred, and nearly always found the three-chatty filter used. The collection of sand for its supply was generally left to the native servant, who on one occasion, to his knowledge, got it from the river, which was no better than an open sewer. The boiling of water was very important. He had insisted upon it while in charge of an asylum, and also in his house, and had even during epidemics never had a case in his own compound. He differed from Surgeon-General Gordon as to the existence of enteric fever in India, and he had been the first to recognise this disease in India in the person of a young officer dying at Meerut. He believed most of the continued fevers, lasting fourteen days, were of this character. Referring to cholera, he gave an interesting instance of the way in which this disease is communicated. In 1872 the child of a European servant had cholera, and the neighbours were called in to rub the child. On visiting the sufferer he urged upon the attendants the necessity for care in avoiding any chance of getting into the mouth of any discharge from the child. While he was speaking he noticed that one of the attendants, a woman, was rubbing her mouth with a dirty handkerchief, which had been used for wiping the child's face, while the father insisted upon kissing the patient. Three days afterwards the man was attacked with cholera and died, and the same evening the woman was attacked with the same disease and recovered.

Dr. C. E. Saunders thought a useful caution had been given against the use of filters. He also was very much at variance with the views expressed by Dr. Gordon.

"*Suggestions for the Amendment of the Artisans Dwellings Acts.*" By J. W. Tripe, M.D., M.R.C.P., Edin., Medical Officer of Health for Hackney.

The improvement of the dwellings of the poor, on which so much has been written and said of late, is a question essentially belonging to the Medical Officer of Health, since it is his representation alone who can set the law in action, whether for the improvement or the demolition of the premises concerned; and if, as I believe, the present state of the law as well as the course of procedure be defective and inconvenient, it is the duty of the Society to point out the directions in which they might best be amended. First it seemed to me a serious defect that when actual demolition is the only practicable course, the work should be entrusted to different authorities proceeding under different Acts, according as the area be large or small, the former being cleared by the Metropolitan Board of Works at the expense of London generally, and the latter by the vestry or local board at the cost of the parish or district. I think that wherever total demolition, whether of individual houses or of large areas, be imperative, it should be carried out by a single authority, and the cost defrayed from a single source; what the authority should be, I would leave to our legislators, provided only it be one representing the entire metropolis, while mere repairs and improvements might be left as at present to the local authorities. The question is complicated by the fact that while the inhabitants of these houses and areas do not as a rule earn more than 15s. a week, the dwellings now erected in their place are let at an average rent of 4s. 4d., and therefore are taken at once by persons earning 24s. or more. The population for whom provision must be found is composed not only of the labouring poor, and those who pick up a living around the docks and markets, but of costermongers and street dealers, for whose donkeys and barrows accommodation must be made, with others who will not submit to the restraint imposed in model dwellings, and lastly, the filthy and destructive. The latter either still further overcrowd adjacent or similar districts, or when dispersed are perhaps improved, but the labouring poor must live in the immediate neighbourhood of their work and can not pay more than 2s. weekly, if so much, for which they have to be content with the wretched accommodation of a single room, or even only a part of one. Landlords had been

unfairly blamed for the state of these tenements, but in fact the cost of keeping such places in repair, owing to the habits of the occupants, is so great, and defaulters are so many, that comparatively high rents are required to cover the losses incurred. The Medical Officer of Health might insist on repairs, whitewashing, &c., but the prevention of overcrowding presents great difficulties. Greater facilities for night visits, without which such overcrowding often could not be ascertained, were urgently required. I would also propose that a landlord might be enabled to obtain from a magistrate an order for the speedy eviction of a tenant on the certificate of the Medical Officer of Health, and his own oath, that a room or house was unfit for human habitation from dirt, dilapidation, or overcrowding. If the owner neglected to avail himself of this power he would forfeit all sympathy when penalties were imposed on him on account of the condition of his property. Houses capable of being rendered habitable by simple alteration or repair should be dealt with by the local authority, and those requiring demolition by the central power, the certificates of the Medical Officer of Health and district surveyor determining the class to which they belonged; but a simplification of the present cumbrous machinery and a diminution of the enormous expense of compulsory purchase and arbitration is necessary. No house should be allowed to be occupied after having been legally condemned, even pending an appeal. Summary powers should therefore be given for closing not only such houses, but also those where a landlord had neglected to carry out an order for repairs to be done within a certain time. Demolition, however, was but the first step; the problem is how to provide fresh dwellings in the place of those pulled down, and for the same class of persons. Neither the central nor the local authority could undertake the work without pecuniary loss to the ratepayers or suspicion of "jobbery." Public bodies, too engaged in other duties, could not exercise the requisite supervision of house property. State loans would involve needless expense in materials and construction, which would be then required to be of the best, and unaided private enterprise would be insufficient to meet the need. The only alternative seemed to be the co-operation of persons willing to take shares in building houses suitable for the classes in question, and content with dividends not exceeding 3 or $3\frac{1}{2}$ per cent., which was all that could be expected in London, even if the ground floors were let out as shops. These considerations, however, did not fall within the field of work of the Medical Officer of Health,

and are mentioned here only to show the difficulties surrounding the question. Houses capable of improvement could be dealt with by existing Acts, but increased powers must be given to the sanitary authorities, and orders should be obtainable from any two local justices, for at present there was too great delay in the issue of such by the police magistrates, a fortnight often elapsing after an application for an order at the Worship Street Court, and the hearing was again frequently adjourned from press of business. The suggestions I would make for dealing with this kind of property are as follows:—

The names and addresses of the actual owners, as well as of the legal owners, *i.e.*, persons receiving the rents, of all houses let in lodgings or occupied by the poor, including all houses under £20 per annum, should be registered with the local authority, and such houses should be visited by an inspector at least twice a year, or oftener in case of complaint. Notices should be served on owners for all necessary improvements, and enforced under the 35th section of the Sanitary Act: the regulations under this clause being made uniform for the whole metropolis instead of being, as at present, left to the discretion of each local authority. If the owner neglected to comply with the order by a given day, he should be subject to a penalty of, say, 5s. per day during such neglect. If he after being summoned still made default, the local authority should have power to close the house or room. No appeal should be allowed against carrying out ordinary sanitary work, as repair or cleansing of premises and drains, or of providing a proper water supply to closets, and a separate supply for domestic use, but only in cases of structural improvements and the construction of drains. As regarded a separate water supply for drinking and domestic use, apart from that to the closets, the local authorities, at present, possessed no powers, though it is much to be desired that such should be enforced in houses of every class. It would be well if regulations were made affecting all houses alike, prohibiting all direct connections of waste and sink-pipes with the drains, and requiring in all new houses proper ventilation and interception of the house drains from the sewer, and the substitution everywhere of better forms of traps for the objectionable bell; and all persons wilfully damaging closets, traps, &c., should be summarily compelled to make good such damage.

Lastly, to determine overcrowding, some limit of cubic space per head must be fixed: this should not be too high, so as to raise the

rent, or so low as to be injurious to health ; 350 cubic feet for each person over twelve years, and less for children, would appear unobjectionable. If this were required, there would be no reason why several persons of different families, *if of the same sex*, should not occupy a single room, but indecent occupation by persons, even of the same family, ought to be put down.

In the discussion that followed, Dr. Edmonds, of St. James', Westminster, Dr. Dixon, of Bermondsey, and Mr. Lovett, of St. Giles', as well as Mr. Greenwell, vestry clerk of Marylebone, Mr. Jones, district surveyor of St. Giles', and other gentlemen, took part. Agreeing entirely with the recommendations made by Dr. Tripe, they insisted that all improvements recoiled on the poor, whom they were intended to benefit ; the cleared areas being subsequently occupied by a better class, and landlords recouping themselves for sanitary improvement of houses by raising the rents out of all proportion to the outlay.

Dr. Dixon complained of the unreasonable delay of the Metropolitan Board of Works in dealing with unhealthy areas unless their clearance would afford opportunities for the erection of warehouses or the opening up of better routes for traffic, instancing an area in his own district which he represented eight years ago, but as to which they had as yet taken no steps, the area in question having meanwhile nearly disappeared by the erection of a Board School, the falling down of some houses, &c. He expressed a strong feeling that the possession and letting of insanitary dwellings should be made penal in itself, and a fine of from 10s. to £5 imposed on the *agent*, since the landlord, if an absentee, might be ignorant of their state. No rent should be charged until the repair ordered had been carried out, nor, he thought, should the rents be raised in consequence until after the expiration of a year.

Dr. Edmonds suggested the utilisation for the class of dwellings required of the sites of the metropolitan workhouses, which might well be removed to suburban districts.

Dr. Saunders called attention to the Labouring Classes Lodgings Acts, of the existence of which many members were unaware, and which had remained a dead letter, though empowering local authorities, with or without State aid, to provide such dwellings, either by building them on lands purchased or leased by them, or by acquiring and improving existing tenements.

An Account of the work done in the parish of St. Marylebone under the Artisans and Labourers Dwellings Acts. By A. Wynter Blyth, M.R.C.S., Medical Officer of Health for St. Marylebone.

Two ideas have been for some time industriously disseminated among the public—viz., that no London Vestry has properly put in force “The Artisans and Labourers Dwellings Acts,” and that, if the Acts were rigidly and thoroughly worked, such action would be a boon to the poor.

It is my desire to give a fair and impartial history of what has been done by the Vestry of St. Marylebone, both under Mr. Cross’s Act and under the Acts associated with the name of Mr. Torrens. Their history will, I think, go far to show that the first idea is altogether erroneous, at all events so far as St. Marylebone is concerned, for the Acts have been applied wherever and whenever it seemed necessary. I will conclude my paper by studying the effects on the poor of the operation of the Acts.

Since only one instance has occurred in which a representation was made under the Act of 1875 (Mr. Cross’s Act), it will be convenient to take that out of the order of time and briefly to relate the circumstances under which the representation was made.

A little more than two years ago a narrow passage from the Edgware Road, just north of Bell Street, led to Linton Place and Bowman’s Buildings, rows of little two-roomed cottages, very small and low, consisting of only one storey; in structure and appearance the kind of shanty the colonist knocks together at the edge of the waste. I need scarcely detain you with an account of their dampness, want of drainage, and defective sanitary state. It is enough to say that they formed the central feature of a scheme submitted to the Board of Works by my predecessor in 1876. The scheme enumerated four blocks of unhealthy areas, block No. 1 being Bowman’s Buildings, with certain continuous streets, courts, and alleys; block No. 2, Providence Place; block No. 3, Edward’s Place; and block No. 4, Britannia Gardens. The first area alone was taken up by the Board of Works. It is, however, interesting to observe that two out of the three remaining have been dealt with successfully under Mr. Torrens’s Act, for Britannia Gardens and Edward’s Place have been practically wiped out of existence, and of the four areas, one only, Providence Place, remains. The Bowman’s Buildings area included 800 persons living in 383

tenements, which would give about two inhabitants to a room if equally distributed. The average rent per room worked out at a little over two shillings; about twenty families occupied the little two-roomed shanties alluded to, and paid from four shillings to five shillings weekly. The death-rate of the area was estimated from the Registrar's returns in 1876, on a three year's basis, to be about eighteen per thousand, in other words, they died at that rate in *their own homes*; but I need scarcely remind the society that not more than half or two thirds of the tenants would die in their own homes, for if they were attacked with fever, or, indeed, other acute affections, they would for the most part be admitted into hospital, so that the quite rural death-rate of eighteen per 1,000 represents something really much higher. The representation was made in 1876, but it was not until 1878 that a provisional order was obtained. In 1880 the houses were not only standing, deteriorated of course in structure and sanitary state, but I was obliged to recommend and enforce some temporary repairs. Nor was it until 1881 that the tenements were vacated. At the present time not one of the 800 displaced lives there, for most of the land is "to let." On one portion a large composite block of artisan dwellings of the usual type is in course of erection. In this case seven years will have elapsed since the representation of the medical officer of health and the actual erection of any new buildings; if the 800 people expelled from the condemned area desire to be re-housed on the old land they will have had to wander three or four years before this facility is afforded them, and when that facility is afforded, without doubt have to pay a higher rent.

From the return at page 342, it will be seen that Mr. Torrens's Act has been put in force no less than twenty-five times; under its provision fifty-three houses have been ordered since 1868 to be demolished, and fifty-one repaired. The number of people displaced from the demolished houses are, according to my calculations, about 380, making, with the 800 before mentioned, a total of 1,180 as the entire number of people displaced by the two Acts. It will be also noticed on referring to the return that, in more than one case, successive reports have been made on the same premises, e.g. two houses in Charles Street, Lisson Grove, were reported upon in 1877, and an order made for their repair; in December, 1880, I was by no means satisfied with their state, and I reported them under the Act; the surveyor considered them capable of repair, and certain

repairs were carried out, yet the condition of these houses was such in the following year that I had no hesitation in again making a report. This time the surveyor declared them not capable of structural repairs; thus they were demolished after three successive reports in four years. Take again Edward's Place, a *cul de sac* that was tenanted for the most part by an Irish colony, in which the houses, never very well built, were always in a disgraceful sanitary state. It was reported under the Act by my predecessor in 1880, and finally demolished as a result of my reports in 1882 and in 1883. In one case I made a report on a part of a house only, that is, a separately inhabited building at the rear of a house, and the order has been issued for its demolition, the freeholder not opposing. A glance at the Definition clause, sect. 3, of the 1868 Act, will show that this is not *ultra vires*, for the word "premises" is defined to mean any dwelling-house or inhabited building. My own tenure of office only dates since the Act of 1879, and therefore my action has of course been regulated by that Act, the chief feature of which is the famous purchase clause (sect. 5), enacting that "notwithstanding anything in the Act of 1868, the owner of any premises specified in the order of a local authority made under that Act, and requiring him to execute any works or to demolish such premises, may, within three months after service on him of the order, require the local authority to purchase such premises."

The effect of this is that no authority can make an order for the repair, however trifling the repair may be, without running the risk, if it be one, of being called upon to purchase. The wording here should certainly be altered. As it stands, it does not harmonise with the spirit of the Act, and may very seriously affect its working. It may cause some surprise, seeing the long list of cases dealt with since 1880, in the face of this purchase clause, that no advantage has been taken of it until recently. But there is an explanation. The greater part of the parish is composed of large estates, and the leases have been within the twenty-one year term; the freeholder, therefore, has not objected, the leaseholder could be ignored, and in one or two of the cases in which the section might have been applied, it is likely enough the owner was entirely ignorant of his power. A case has arisen in Horace Street in which notice has been given to the authority to purchase, and an official arbitrator has been appointed. I had hoped, before this paper had been read, the arbitrator would have given his award, but such is not the case, and, as the matter is *sub judice*, I think it

best not to touch upon the many interesting points which may be raised upon the question of the arbitration. It is of course evident that the success of the Act, as it stands, mainly will depend upon the principles that are considered just to adopt in the valuation of the property. It cannot be denied that, so far as the intention of Mr. Torrens's Act goes, that intention has been successfully carried out in Marylebone, but, on the other hand, it must not be forgotten that there have been the facilities already alluded to for its operation, and that no case has been contested. Let me now ask, what has been the effect of these improvements on the poor? Of the 1,000 people displaced, one-third of these were certainly of the criminal class, of low and drunken habits; the disturbance of their old haunts renders it more difficult to indulge in thieving with impunity, and they have less money for food and gin. The rest were nearly all poor working people, living from hand to mouth, and with difficulty paying the comparatively moderate rents of their old tenements. The new houses which have been built on the vacated sites are superior to the old, and, naturally enough, superior in rent. Thus, in Charles Street, Lisson Grove, the old rent averaged 3s. per room, the new 4s. This extra shilling is quite sufficient to make it impossible for the old tenants to come back. The main tendency of the Artisans Dwellings Acts, as at present administered, is to give a better and increased accommodation for the fairly-paid artisan, but to decrease the living room of the labourer, of the needlewoman, and of the class generally denominated as poor. The contentment that a writer in the *Times* speaks of is not a content with a tumble-down tenement, but it is a content with the low rent that its sanitary condition insures. The crossing-sweeper naturally enough prefers his liberty to live in a wretched hole, for which he pays 1s. 6d. per week, than to have his habitation swept away and be driven into the workhouse. Why, to these people sanitary improvement is a veritable car of Juggernaut, pretty to look at, but which crushes them. Not a house is rebuilt, not an area cleared, but their possibilities of existence are diminished, their living made dearer and harder. The majority of the platform speakers on the homes of the poor have failed to see this, but it is realised painfully by those whose duty it is to put the sanitary Acts in force. If every vestry had worked the Artisans and Labourers Dwellings Acts thoroughly, an appalling amount of misery, of overcrowding, and of poverty would have been the result. Until tenements are built in pro-

portion to those demolished at low rents, it is not humane to press on large schemes. What is to be done must be done gradually. The condition of the poor admits of only this one remedy—building, if it be possible on a commercial basis, healthy tenements for which the weekly payment does not exceed a tenth of the weekly wage of the labouring class.

ST. MARYLEBONE.

Proceedings of the Vestry under the Artisans and Labourers Dwellings Acts, 1868 and 1869.

Date of Order.	Situation of Premises.	Order of Vestry.	Remarks.
Oct. 28th, 1869...	York Court, Nos. 15, 16, 17, 18, 19, 20, 21 & 22	To be demolished	The order of the Vestry not having been carried out, after the expiration of three months, the Vestry ordered the Surveyor to demolish the premises, which was done.
April 13th, 1871	Stephen Court (6 Houses)	To be demolished	The order of the Vestry not having been carried out, after the expiration of three months, the Surveyor was instructed to demolish the premises, which was done.
April 20th, 1871	St. James' Place, Bell Street (5 Cottages)	To be repaired	Order carried out.
June 1st, 1871 ...	Grafton Court, Nos. 10, 11 & 12	No order made	Owner agreed to carry out repairs.
Jan. 2nd, 1873 ...	Grotto Place, Nos. 1, 2, & 3	No order made	Structural repairs executed.
Nov. 16, 1876 ...	Britannia Gardens, Moor Street (12 Houses)	To be demolished	The order of the Vestry was suspended conditionally, to enable the owner to sell the premises, and warehouses were subsequently erected there.
April 19th, 1877	Charles Street, Lisson Grove, Nos. 1, 2, 3, & 4	To be repaired	Order carried out.
Aug. 9th, 1877 ...	Salisbury Place, Lisson Grove, Nos. 3 & 5	No order made	Structural repairs executed.
Nov. 1st, 1877 ...	York Court, Nos. 3 & 9	To be repaired	Order carried out.
June 17th, 1880	Grafton Court, Nos. 10, 11, & 12	No order made	Necessary repairs carried out by owner.
July 15th, 1880...	Edward's Place, Seymour Place, Nos. 10, 11, 12, 13, 14, 15, 16, 17, 18, & 19	No order made	Owner carried out necessary repairs.
Dec. 16th, 1880...	Charles Street, Lisson Grove, Nos. 1, 2, 3, 4, & 31	No order made	Structural repairs executed.
Oct. 27th and Nov. 3rd, 1881	Charles Street, Lisson Grove, Nos. 1, 2, 3, 4, 12, 13, 15, & 31	13, 15, & 31 to be repaired, 1, 2, 3, 4, & 12 to be demolished	Order carried out. New Improved Dwellings constructed on portion of site.
Dec. 8th, 1881 ...	Orcus Street, No. 13	To be repaired	Owner not having executed repairs, Surveyor was instructed to do so, and executed the works at the Owner's expense.
Nov. 2nd, 1882...	Edward's Place, Seymour Place, Nos. 15 & 16	To be repaired	The Freeholder (the Lessee having less than 21 years' interest in the premises) not having executed the repairs after the expiration of three months, the Surveyor was instructed to take down and remove the premises, and to sell the old materials belonging to the same, which was done.

Date of Order.	Situation of Premises.	Order of Vestry.	Remarks.
Feb. 22nd, 1883	Edward's Place, Seymour Place, Nos. 8, 9, 10, 11, 12, 13, 14, 17, 18, & 19	To be demolished	The order of the Vestry not having been carried out, after the expiration of three months, the Surveyor was instructed to take down and remove the premises, and to sell the old materials belonging to the same, which was done. Order carried out.
Feb. 22nd, 1883	Charles Street, Lisson Grove, No. 6	To be demolished	
March 1st, 1883	Little Durweston Street, No. 15	No order made	The Owner having executed certain repairs to the satisfaction of the Surveyor, no order was made in the matter.
March 15th, 1883	Horace Street, No. 17	To be demolished	The Lessee subsequently asked permission to execute certain repairs in lieu of the complete demolition of the premises, and the matter was left in the hands of the Surveyor, and the premises were put in a sanitary condition, being almost wholly rebuilt. Premises rebuilt.
June 21st, 1883 ...	Providence Place, No. 18	To be demolished	
Aug. 9th, 1883 ...	Horace Street, Nos. 11, 12, 13, 14, 15, & 16	To be demolished	Notices of appeal were given to the Vestry with respect to Nos. 11, 12, 13, 15, & 16, but the notice relating to Nos. 11, 12, & 13, was subsequently withdrawn, and the Vestry were required by the owner to purchase the premises, under the 5th Section of the 42nd and 43rd Vict., cap. 64 (Artisans' and Labourers' Dwellings Act, 1868, Amendment Act, 1879). The Vestry have therefore applied to the Local Government Board to appoint an Arbitrator under Section 7 of the above Act, to settle the amount of compensation to be paid. The Vestry have also been asked to purchase Nos. 14, 15, & 16, and the matter is under consideration.
Nov. 1st, 1883 ...	Jane's Place, Great York Mews, Nos. 1 & 2	To be demolished	
Nov. 1st, 1883 ...	Building at the rear of 35, William Street, Lisson Grove	To be demolished	
Nov. 22nd, 1883	Capland Pl. North, Lisson Grove, Nos. 1, 2, 3, 4, & 5	To be repaired	Works in progress.
Nov. 22nd, 1883	George Street, Lisson Grove, Nos. 16 & 17	To be repaired	Works executed.

Dr. Dudfield, in opening the discussion, commented on the warm interest which the public had recently manifested in the condition of the dwellings of the poor. Referring to Torrens's Act, he argued that, owing to the expense and delay incurred in enforcing its provisions, it was almost useless as a means of keeping in proper repair tenemented houses. One of the chief difficulties to be met is that poor property pays the best; as evidence that the poor had to pay for any improvement effected in the condition of their dwellings, he instanced six cottages in Kensington, which

were repaired at a total cost of £30, with the result that the landlord raised the rents £30 per annum. Local authorities should have the power to purchase house property at a value which was not based upon the rent which was being received, but which had regard to its insanitary condition. He was of opinion that if regulations were made under the 35th section of the Sanitary Act, and carefully enforced, they would do almost all that Dr. Tripe suggested was required. But he thought that it would be far better for the local authority to undertake the work itself instead of compelling the owner to remedy defects in a house. Finally, he could not free his mind from the belief that before this question was solved there would have to be fixity of fair rent.

Dr. James Edmunds feared that harm would result if poor property were too freely demolished, as it would tend to drive people into other parts and thus cause overcrowding. He also had observed that every attempt to improve the habitations of the poor led to an increase of their expenses. He then referred at some length to the buildings for artisans which had been erected at Noel Park and at Hornsey.

Dr. Dixon argued that neither the local authorities nor the Metropolitan Board of Works could clear areas or rebuild without loss, and it was unfair for them to persevere with a course which necessitated the spending of large sums of money of other people in the provision of habitations for one class. He gave an interesting account of the delayed action of the Metropolitan Board of Works, stating that from the time he had made a representation until a decision was come to, five years had elapsed, and during that interval a Board School had been built, and in fact the condition of the area had altogether changed. The Sanitary Acts should be more penal; at the present time the magistrates too frequently adjourn cases and inflict inadequate fines; the minimum penalty should be fixed and should be made to fall upon agents as well as owners, who themselves derive considerable profit from such houses. The landlords should not be permitted to receive any increase of rent for twelve months after any improvement had been carried out on the requirement of the sanitary authority, and no house should be allowed to be occupied after an order were made and pending the hearing of an appeal. He also commented on the insufficiency of Torrens's Act, especially when the owner opposed.

Mr. Greenwell was of opinion that if there were an improvement in the machinery, the Acts would be found to be thoroughly useful,

and that the vestries who knew all the local conditions could better carry them out than a central authority, and he referred as evidence to Dr. Dixon's history of the delay in the Metropolitan Board's proceedings.

Mr. Jones pointed out that he had received much assistance at the hands of magistrates, who had frequently made orders for closing houses. The Nuisance Removal Acts were sufficient for the improvement of property, but the difficulty was with the destructive habits of the people dwelling in tenemented houses. He felt very strongly that Cross's Act would never suffice to provide houses for the very poor.

Dr. C. E. Saunders called attention to the Labouring Classes Lodging Houses Acts, giving power to build artisans' dwellings, and asked if they had ever been adopted by any local authority.

Dr. Bate, in commenting on the absence of penalty under the Nuisance Removal Act until the magistrate's order had been disobeyed, observed that the magistrate in his district always grants costs to the vestry. With reference to the air-space which sanitary authorities deem necessary, this should be 350 cubic feet for adults, and certainly not less for children.

Mr. Wallace gave a brief history of the operation of the Acts in St. Giles'. From 1875 to 1879, 200 separate properties had been dealt with; the people who came to occupy a site which had been previously cleared are altogether of a different class from those who formerly lived there. The 1879 Act had made that of 1868 unworkable; he thought too much responsibility was thrown on the surveyor. With reference to compensation, this must be based on the rent received.

"Nine Years' Stewardship as Medical Officer of Health at King's Lynn, its Difficulties and its Results." By W. G. Walford, M.D.

Having a short time since made some remarks on the above subject to your President, it struck him that there were many peculiarities in my position at Lynn that might render a narration of my experiences there somewhat interesting to you at the present time. At the same time, I feel some little diffidence in complying with his request, as I fancy that whatever experiences I may have had in my small district can be as nothing compared with what most of you must have encountered in the very large districts you occupy.

King's Lynn, I must tell you, is not like the general run of country towns, it is what one may call a small large town, or a large town in miniature. When I took office, in May, 1873, the population was between 17,000 and 18,000. It is a regular commercial, manufacturing, seaport town. It is the central town of a large district, and has a very large corn market. Ships, some of good size, trade thither from all parts of the world, though principally from the north of Europe. It has railways running in every direction, and altogether a very large amount of business is done there. It also emulates a large town in being closely populated, in having the same vices walking abroad, the same wretched slums, squalid misery, poverty, and overcrowding. In fact, with the exception of its dens of thieves which Lynn fortunately has not, it might be said closely to resemble a small slice of London.

I should tell you that one district is almost exclusively occupied by the fisher people, who are quite a race *per se*. They are, I believe, originally of Danish extraction; they keep to a great extent to themselves, and though I remember a few most brilliant exceptions, yet they are as a class about the most drunken, improvident, dirty, and dissolute people that one ever fell amongst.

A year or so before I took office, the public there began to be exercised in its mind about the condition of the dwellings of the poor. Reporters were engaged by the local papers to penetrate the slums and report their discoveries and the condition in which the poor lived. Letters on the subject also appeared in the papers, and altogether the same agitation was then going on in Lynn as is now going on with regard to London in the daily papers.

At length, after having vainly endeavoured to compete with an epidemic of small-pox which had been going on in the town for about three years, the Corporation did me the honor to appoint me as Medical Officer of Health. The result of Sanitary measures was, that in a fortnight the back of the epidemic was completely broken, and in six weeks every trace of small-pox had disappeared.

I then proceeded to organise my forces so that I should always be kept informed of everything that was going on that could concern me. I managed to get the Corporation to allow a fee of 2s. 6d. to the Parish Medical Officers for each report of any matter requiring my attention; then there was an army of visiting ladies distributed all over the town, and they were requested to make a similar report to me about anything that they thought I ought to know of.

I may also say that though I continued in private practice, yet I was fortunate enough to be to a great extent independent of my profession. Thus while on my rounds as general practitioner, I was able to learn a very great deal of what was going on around me. I was also enabled to prosecute my duties without fear or favour, and to escape any little jealousies that might have existed otherwise among my brother medical men, with whom I remained always on the most cordial terms.

Then the police were instructed to give me all requisite information. For a time the Police Superintendent was my Inspector of Nuisances, and a very able one he was.

My brother medical men often kindly gave me most valuable information. I also received information from private sources, and from the masters and mistresses of schools. I was always about myself, and accompanied by my Borough Surveyor used, twice a year, to make a systematic inspection of every part of the town, and three times a year of certain parts.

So you will see I was very favourably situated, and that scarcely anything could have gone on without my soon hearing of it. In fact, when on one occasion Dr. Thorne Thorne was down there investigating the circumstances attending an outbreak of scarlatina in the adjoining district, he complimented us by saying that we were somewhat ahead of the world.

We soon set to work to improve as far as we could the dwellings of the poor, and the sanitary condition, or rather insanitary condition, of their surroundings. In this I may say I was materially assisted by my Corporation, for I think that never did the Borough Surveyor (who was also Inspector of Nuisances) or I report to them the improper condition of any dwelling but an order was issued to the landlord for its repair, or for the rectification as far as possible of any sanitary defects, thus making use of Acts of Parliament which I find have not been generally enforced.

However, four-fifths of our work was accomplished without the necessity of reporting the matter to the sanitary committee, for it generally happened that a representation made by either of us to the landlord or agent was attended to, partly because the owners were often respectable people who only wanted to be told of it to repair their property, or because the landlords took advantage of our complaints to raise the rents when serious defects were rectified, but principally because they did not like the idea of being reported, and of their names being published in the local papers, or for various other reasons.

Then again, Lynn being a Parliamentary Borough where political feeling runs high and party spirit is strong, the poor were often being visited by canvassers for parliamentary or municipal honors, or by religious people of various denominations, or, as I said before, by the visiting ladies; and as it was the object of all such people to stand well with the poor and to repeat any complaints of their dwellings, or ventilate any grievances, especially when created by political opponents, in one way or another very great improvement was effected in the dwellings of the poor during my term of office. I may say that the rents were low throughout the town.

I soon began to watch the effect of these improvements, and I had good opportunities for so doing, as I was able to keep my eye on various families in their flittings from one home to another and whether they improved or not.

We soon found that we had two classes of poor to deal with, namely, those who would help themselves and take advantage of improvements and those who would not. The former, as a rule, shunned the lower class of property, and being more thrifty were able to pay a better rent and to choose more respectable associates. Such people would often say to me "Look here, sir, do you consider this house fit for me to live in? I would willingly pay a higher rent if I could have it more comfortable." Of course such people were soon accommodated by their landlords, and as they raised themselves in the social scale they would seek better houses in better localities.

But as regards the other class of people, I believe that if you gave them a palace they would soon make it a dung heap. It not unfrequently happened that we reported to the Sanitary Committee that so-and-so was living in a filthy house, with a rider to the effect that he had been reported before, and that he had fouled every house that he had lived in before. The same thing might be said of whole yards containing many houses, namely, that on each of our visits we found that the occupants, after having had their dilapidations, &c., seen to, relapsed at once into their former condition. Such people were the terror of landlords; they often did not pay their rent and had no furniture worth seizing, while they would wreck the house for firewood.

I remember one cottage in particular belonging to a friend of mine, which after being nicely repaired, was utterly wrecked and no rent paid. The landlord ejected the tenants and barricaded the door to prevent the house from being used. The barricades were

pulled down and put on the fire, and a family entered and took possession, paying, of course, no rent. He had the greatest difficulty in getting rid of them. I remember other cases, some who were in squalor and filth when I took office were no better when I resigned. I think I have noticed and have heard it remarked, that when, if ever, such people turned over a new leaf and improved themselves, they left low neighbourhoods and made room for others of the same class to fill their places.

Thus at the end of eight years very many of the lower class of slums presented much the same appearance as at first, although they had been perhaps twice repaired and put into serviceable order, so that I had not the heart to compel further repairs so long as the sanitation was fair, knowing that the landlord had done all that could be expected and often had not got his rent. In my opinion the wretched condition of the poor, and of their dwellings, is very largely caused by their own improvidence, intemperance and vice.

Something may sometimes be due to the rapacity of landlords, and something to want and misfortune, but it must be remembered that through an abundance of work, and other causes, there was very little real want in my district, and rents were low.

I noticed, too, that many of the poor liked to live close to their work, and huddled together in wretched hovels near it rather than go half or even a quarter of a mile further, where they could get better accommodation perhaps for less rent. This often causes a great pressure and a high rental by their choosing localities which would be useful otherwise for commercial purposes. Were the upper classes to do the same, instead of preferring to live in the suburbs of a town, in the centre of which their business is situated, the pressure would be great indeed.

Then as to dealing with overcrowding. It not uncommonly happened for me to visit a spot where a man and wife and large family were packed much too closely in a small room, but where, though there were signs of poverty, the place looked clean and tidy. The man would often say, "I know we are overcrowding, sir, but I have been ill and cannot do full or regular work; I should like to have as big a house as you, but cannot afford it." In such a case no action could be taken. We could not give him a bigger house, or turn him into the street, or compel him to go into the Union, so we had to leave him where he was. Or again, if we took action in such cases we often found we only produced overcrowding elsewhere.

Again, it was often most difficult to find out when and where

overcrowding existed, as though one often had shrewd suspicions of its existence, it was impossible to learn the truth, as there was often some plausible story told that one or other of those I saw in the room really slept elsewhere, and always a denial that others came in, so it was impossible to find out how many fisher lads came in for a shake down at night time.

In fact I actually think that where overcrowding exists, a dilapidated house is for sanitary purposes better than a sound one, for though the former lets in the rain of heaven it lets out the foul air.

Now as I have told you that overcrowding, where it did exist perniciously, only took place among the lowest class and the poorest of tenements, it was surprising what fine healthy young fishermen turned out of these insanitary dwellings, and I attribute this mainly to holes in ceilings and defective tiling, &c., allowing of ventilation.

On the other hand it often happened to me in the course of my practice to have to attend people who were clearly suffering from want of more pure air, and these were often those who were not suffering from overcrowding in the usual sense of the word.

Say a respectable, well-to-do mechanic, with a comfortable home and everything clean and tidy, sleeping with his wife and one or two children in a room perhaps 13 feet by 10 by 8. The chimney carefully stopped, the windows packed, and perhaps a gas-burner burning late or used to warm the room. In this case, though legal overcrowding did not take place, actual overcrowding did, and the consequences were more serious, because the house was a tight one. But suppose the same man with a family of eight children, five sons and three daughters, and their house containing but three bedrooms. The father and mother occupy one room, the daughters a second, and the five sons a third, which perhaps does not contain 900 cubic feet. Here we have actual overcrowding, and that too in a tightly-built house. Such instances one often sees in private practice, and it takes place among a class with which the Medical Officer of Health has as a rule nothing to do with. Still it affects the health of the nation, and I consider it concerns us. Of course by talking to the parents you may sometimes get them to put a son out to lodge, but all this takes time and trouble. And supposing the father says he prefers to keep his sons at home, from the danger of bad company, what can you do then?

I am instancing a country town where rents are low, but in London, where rents are high, overcrowding must be common enough among respectable people who cannot pay high rents. I

think I may say I have been able to look at this matter of the proper housing of the poor from almost every point of view. For two periods of four months each I acted as deputy for two parish Medical Officers. Then, as I have told you, I was a general practitioner for many years before I was Medical Officer of Health, and all this time in a town containing many poor huddled together, and I was able to see a very great deal that I thought ought to be done for their amelioration: in fact I am not sure that I was not disposed to complain as loudly as anyone about the housing of the poor, and that someone ought to do something to improve their condition somehow. But when I got into office and had every facility afforded me, and my Corporation were quite ready to support me by carrying out Acts of Parliament, which it seems have for various reasons not been enforced, the more I saw of the matter the more it appeared to me that what at first seemed so simple was fraught with difficulties at every possible turn.

It would appear to me that the existing Acts if enforced are almost sufficient to ensure a considerable improvement, or at all events as much improvement as can well be effected structurally in the domiciles of a certain class. Then comes what Mr. Bright once called "the residuum," and for these, for reasons before given, very little can be practically carried out, unless one puts a policeman at the door of each house occupied by such people, to refuse admission to any after the registered number had entered, to see the occupants did not stop up chimneys and other means of ventilation, and to see they did not illuse the premises by cutting up the w.c. door for firewood, or commit other trifling irregularities. Not until we adopt some such measure as this—and I am not sure even then—shall we be able to effect any great improvement.

Doubtless it would be a great thing to purchase large tracts of land in certain suburbs of large towns and on lines of railway, so that houses could be built thereon for the working classes where they would have elbow-room, and would be able to take advantage of workman's trains. But then who is to do this? Certainly the Sanitary Authority might do it; but few members of Sanitary Authorities would care for the trouble. If a Corporation went into the market to buy land the price would at once rise, and after all they might find they were benefiting other districts than their own; and again, as I said before, members of the working class like to live near their work. Still some such plan as this, carried out either by the Corporations themselves, or, better still, by private

companies, would appear to me the only way of relieving the pressure—and it would certainly relieve it. I know of no other feasible plan.

I have said that we had an excellent plan for reporting infectious diseases. Now, not very long before I took office, we had a very severe epidemic of scarlatina, which only stopped when it had worn itself out from sheer want of more material to which to spread.

Soon after I came into office, if any cases occurred, I was at once informed of them. I adopted sanitary measures, supplying disinfectants, and furnishing the people with printed copies of rules how to act, and of extracts from the Acts of Parliament on the subject, and when the patients were well I had the houses disinfected with sulphur.

The parents and neighbours, remembering the virulence and mortality of the previous epidemic, gladly followed the rules prescribed, and the disease did not spread. This went on for several years, and for some time scarlatina became a rare occurrence; if introduced from without, it was nipped at once in the bud, and I began to think we were getting very near a Utopian condition. Some ten years passed, scarlatina was general throughout the country, and was being introduced to Lynn in all directions, and to my dismay I found among the poor a general disinclination to believe in or carry out sanitary measures. The very immunity we had enjoyed for so many years had begat a contempt for the disease, and a disbelief in its severity.

The sufferers who were attacked—mostly children, of course—were generally the children of young parents, who were little more than children themselves at the time of the previous epidemic, and who consequently remembered little of it. All their ideas were that scarlatina was a trifling ailment of childhood, a good thing to be got over, and quite innocuous, and until death was in the house they would hardly believe in its severity.

Among many of the people with whom I had to deal I was utterly unable to impress the necessity for sanitary precautions, consequently the mortality ran very high. I think, therefore, that in all probability, if the reporting of infectious diseases becomes general, it will at first be followed by a great reduction in the spread of such diseases in the country. But that this immunity will beget a condition of false security, and a consequent disinclination to follow sanitary precautions, and then a further spread of these diseases, until the public becomes better educated in these matters, and this is what we must eventually come to, namely, *Education in Sanitation*.

The President, after some remarks in favour of the system described by Dr. Walford for obtaining information concerning cases of infectious disease, said that he thought all Poor Law Medical Officers should receive payment for certificates. In Kensington 3s. 6d. was paid for those relating to non-paupers. Referring to the recent outcry against landlords, he admitted that he felt some sympathy for them, as the destructive habits of tenants compelled the landlord to charge high rents, of which they often received but a small portion. The greatest difficulty to be overcome was overcrowding, as it was not easy to know what to do with the people when they are removed.

Mr. W. Blyth considered that death-rate was greatly influenced by peculiarities of race, he noted that whenever typhus broke out it was always in the Irish quarter. Age should also be considered in estimating the death-rate. He, too, thought that much might be said on behalf of landlords, and that Torrens's Act might, by being too freely applied, lead to difficulties.

Mr. Moore recommended that the cost of local improvements should be paid for out of a common fund.

Dr. Armistead stated that the water supply of King's Lynn was very liable to pollution from the building of houses on the banks of the river. The situation of the town exposed it to dampness from the surface water.

Dr. Dixon enquired as to the height of the houses, and whether the inhabitants slept on the ground floor, as possibly affecting the death-rate from phthisis.

Mr. Corner made some remarks on the condition and sanitary arrangements of Poplar. He believed that if regulations for tenement houses had been in force, great improvement would have resulted.

Mr. Lovett thought that better provision should be made for those who are displaced by the removal of houses.

Dr. Waterworth considered there was gross exaggeration in many of the statements lately made with reference to the condition of house property.

Dr. Walford, in reply, said that phthisis and bronchitis were prevalent at King's Lynn, whilst cancer and infectious diseases were rare. The houses were mostly of two storeys high, the bedrooms being in the upper one. The walls were damp in all classes of houses.

"Remarks on the Examination of Water for Sanitary Purposes."
By Charles E. Cassal, F.I.C., F.C.S., Demonstrator, Department of Hygiene, University College, London ; and B. A. Whitelegge, M.D., B.Sc.

The analysis of water is a subject which has of late years excited the keenest controversy among chemists and sanitarians. In spite of painstaking investigations and exhaustive discussions, there are few subjects in the whole range of chemical science which call forth so much difference of opinion, not only with regard to the methods to be employed, but also to the accuracy of the results obtained, and the degree of importance and significance to be attached to them. At the present time additional interest will perhaps attend discussions on this subject, in consequence, firstly, of the suggestion of novel modes of investigation, depending upon the cultivation of organisms, and thus differing entirely from those in common use; and, secondly, from the recent forcible and apparently damaging criticisms to which certain of the most commonly-accepted methods of analysis have been subjected.

The object of the analyst is to determine—

1. The presence or absence of impurities in the water he is called upon to examine.
2. The nature and quantity of such impurities if present; and to form, so far as he can upon this evidence, an opinion as to the wholesomeness or the reverse of the water supply in question.

The old method of exactly estimating the different mineral constituents in the residue of a water is not of any particular importance so far as its sanitary aspects are concerned; in some rare cases it may be desirable to know the quantities of lime, magnesia, &c., actually present, but the matter of greatest moment to the sanitarian, and that in which the chief difficulty lies, is the determination of the organic impurities. Various methods have been proposed and employed for this purpose. It has been pointed out that they may all be classed under two heads—viz. (1) Those which aim at the estimation of the organic matter in the water itself; and (2) Those which aim at its estimation in the solid residue left on evaporation.

Confirmatory evidence is afforded by the presence or absence of nitrates from the oxidation of nitrogenised organic matter, and their quantity if present; by the amount of chlorides, which almost invariably accompany pollution from animal sources; by

the microscopic examination, a point which is far too frequently neglected; by the ignition of the water-residue; by the smell; and by the appearance of the water when examined in a two-foot tube or a quart decanter.

Of the processes which have been employed for determining the organic matter in the water itself we have, firstly, the oxygen or permanganate process, which aims at a measurement of the amount of pollution by the rapidity and extent of decomposition of a weak solution of permanganate of potash, acting upon the oxidisable matter present; and, secondly, the Wanklyn process, which makes the amount of ammonia evolved, on boiling with a strongly alkaline solution of permanganate of potash, a measure of the quantity of nitrogenised organic matter present.

The chief process for determining the organic matter by an analysis of the dry residue, is that due to Frankland and Armstrong, who by means of a combustion experiment—*i.e.*, by burning the residue with oxide of copper and measuring the amounts of carbonic acid and nitrogen evolved—estimate the quantity of organic carbon and organic nitrogen present in the solid matter obtained on evaporation.

The oxygen process as originally devised by Forchhammer is unreliable and unsatisfactory; with certain modifications and precautions, however, it forms a very valuable test, especially as affording confirmatory evidence. But we are here chiefly concerned with the two processes which have been generally regarded as rival and antagonistic ones—viz., the Frankland process and the Wanklyn process, the latter of which has unquestionably been, and still is, the most popular of all. As regards the alleged antagonism between these two methods of water analysis, our own experience leads us to agree with Dr. Cornelius Fox, that in skilled hands, and when proper precautions are taken, their results are closely concurrent, in the sense that the opinions based upon these results are substantially the same. In view of the evidence which Dr. Fox adduces, most people will probably feel disposed to agree with him also. It will be remembered that he made an attempt—by collecting and tabulating the data of analyses (made by chemists using the rival processes) of different samples of the same waters obtained under the same circumstances—to institute a comparison between the two. On page 63 of his excellent work on “Water, Air, and Food,” he thus sums up the results of his enquiry:—

- I. “In one instance only out of ninety-nine analyses, details of

ninety-three of which are in my possession, is there a distinct conflict of opinion, and in this exceptional instance the divergence in the results obtained is easily explained.

2. "The opinions do not in a great many instances coincide exactly, but the adjectives denoting them are modified by some qualifying adverb.

3. "When the results of analyses made by the two processes at or about the same time do not at all agree, the divergence is generally due to the neglect on the part of those who practise the Wanklyn, Chapman, and Smith process, to estimate the amount of nitrates and nitrites, and to be guided by the evidence thus afforded.

4. "The results are not concordant unless the analyses are performed upon the same water at the same time.

5. "A really bad water would not be likely to escape detection by either process if the nitrates and nitrites are always estimated."

A table is given on pages 64 and 65 of the same work, in which the results of the analyses, made at about the same time, of ten samples of water from very various sources, together with the opinions based on these results, are stated. The opinions are as follows:—

Sample	Frankland Process.	Wanklyn Process + Nitrates.
1	Good	Very good
2	Horribly polluted	Horribly polluted
3	Indifferent	Not first-rate
4	Suspicious	Suspicious
5	Good	Pretty good
6	Good	Good
7	Good	Moderately good
8	Bad	Bad
9	Good	Good
10	Pretty good	Pretty good

It would be out of place, and moreover far beyond the scope of this paper, to fully describe and consider the details of the Wanklyn and of the Frankland processes, but it may perhaps be convenient to recall some of the objections which have from time to time been raised against their validity.

Inasmuch as it is necessary in the first stage of the Frankland process to boil the water with sulphurous acid, and subsequently to evaporate it to dryness, the objection has been made that some organic matter must thereby of necessity be lost or destroyed. Although it is perfectly conceivable, and indeed probable, that during a long process of evaporation organic matter may disappear, and especially that boiling with sulphurous acid may well produce disastrous effects on the organic matter in the water, yet a little too

much seems to have been made of this objection. It has been said, but the ground on which the statement rests appears to be of the slenderest description—that the dangerous organic matter in water is probably highly volatile, and the Frankland process has been impugned as being incapable of measuring such volatile substances. At present, of course, this volatile poison is purely hypothetical, and consequently cannot very well be brought forward as an argument against the process; and the destruction of organic matter being very small, and not affecting the constancy of the results, the objection loses a great deal of its force.

Again, it has been asserted that the error of experiment is sometimes greater than the total quantity to be measured, and that the presence of a large amount of nitrates altogether vitiates the results. It is certainly a fact that the liability to experimental error in this process is exceedingly high, compared to that in ordinary chemical determinations of the same kind.

As regards the Wanklyn process, many objections have also been urged. By the boiling with alkaline permanganate it is asserted that the whole of the nitrogen present is not evolved as ammonia; and that the quantity of ammonia obtained is influenced by the degree of concentration and by the rapidity of distillation. As regards these objections, it should be remembered that Mr. Wanklyn himself was the first to prove that only a part of the nitrogen was given off, and to state that the process was not one for the estimation of organic nitrogen. Some water analysts have unquestionably returned in their reports as total organic nitrogen, the amount of nitrogen obtained as ammonia by boiling with permanganate. Nothing could be more fallacious, or better calculated to bring the process into discredit. Mr. Wanklyn has of course very strongly condemned this proceeding.

It cannot be too strongly insisted upon with regard to these processes, that their results do not *alone* justify the formation of an opinion as to the purity of a water, but must be taken together with the other evidences of pollution already enumerated—viz., amounts of nitrates and chlorides, microscopic examination, &c. The much too common neglect of this principle is, in our opinion, the main cause of discrepancies among water analysts. Again and again, even in cases of the greatest importance, conclusions are arrived at apparently based solely upon determinations of "albuminoid" and "free" ammonia, or of organic nitrogen and carbon, or even sometimes *solely* on the estimation of nitrates and chlorides.

As to the estimation of nitrates, this again has been a much discussed point—strongly condemned by Mr. Wanklyn and his close adherents, and as strongly insisted on by Professor Frankland; indeed, an exaggerated importance has been attached to the nitrates by those who follow his method, if not by himself. Our own experience points to the necessity of estimating the nitrates in every case, and we can fully endorse everything that is said in support of such estimation by Dr. Fox and others.

Such, then, briefly stated, are the methods at our disposal. They have been of late severely criticised, and their value from a sanitary point of view called into question; in fact, they have to some extent been “put upon their trial.”*

With some of the most recent of these criticisms we now propose to deal as briefly as possible.

The first point to be considered is embodied in the words of Dr. Buchanan—viz., that “we must go beyond the laboratory for evidence of any drinking water being free from dangerous organic pollutions;” and further, that “the chemist can tell us of impurity and hazard, but not of purity and safety.”

Secondly, it has been asserted that in cases where the absolute and relative amounts of impurity in the samples submitted to analysis are previously accurately known, the results of the analyses are often widely discrepant, both with the Wanklyn and the Frankland processes.

Thirdly, it has recently been said, and by very high authorities, that the cultivation processes are destined to supersede the present methods; and, to quote Dr. Angus Smith, that “water analysts must be prepared for a new order of things.”

As regards the first of these objections—that chemical analysis cannot distinguish between injurious and harmless organic matter in water—it is undoubtedly to a great extent true. Moreover, it is obvious that there must be a limit to the minuteness of the quantities that can be determined. No merely chemical process could, of course, be expected to determine whether the albuminoid matter, if any, is living or dead; or whether, if living, the organisms are hurtful or harmless. In comparing, for instance, typhoid stools with healthy stools as regards water pollution, we must not look for critical differences in the amount of nitrogen or carbon present, or of ammonia produced by destructive treatment;

* Dr. Buchanan.

but rather, if a chemical difference is to be sought for, by direct experiment we must attempt to isolate some principle characteristic of one or the other. A given weight of enteric stool is dangerous as regards enteric fever, in proportion to the amount of infectious matter in it, whatever that may be; but the chemist should only report, and should only profess to report, on the quantity or proportion of organic impurity, be it noxious or not.

But while analysis cannot tell us of *specific* pollution, it can tell us that a water is *polluted*, and that such a water ought to be condemned. Where even "innocent" pollution, if there be such a thing, has occurred, specific pollution *may* occur; and, apart from this, putrefaction may render it hurtful even without the presence of any specific poison. The æsthetic side of the question may, perhaps, also be considered. Drinking a sewage-mixture, more or less strong, may possibly for a time, and under favourable circumstances, be harmless, but it is not a habit which commends itself to the taste of ordinary persons.

The objection that a quantity of specific poison too minute for detection by analysis may still be able to produce its specific effect, cannot, of course, be denied. In such cases, if they ever occur, there is but one course open, at least in the present state of our knowledge. We must "go beyond the laboratory," at any rate beyond the ordinary laboratory, and perform a physiological test. *Fiat experimentum in corpore vili.* A typhoid "germ," if such things exist, would probably be, so far as the analyst is concerned, merely an extremely minute fragment of albuminous matter. Even in large numbers, therefore, these "germs" *may* be too minute to be detected by chemical re-agents; but, as a matter of fact, practically no cases occur in which the poison is present without much more than enough concomitant organic filth to allow of the pollution being detected, or without evident and unmistakable signs of pollution past or future such as are afforded by the estimation of oxidised nitrogen; and it needs no sacrifice of our faith in water analysis to admit its inability to cope with those possible, though most improbable, cases in which such excess of organic matter, or such other signs of danger, are absent. It would surely be absurd to maintain that an army is useless because we can conceive of its being defeated under certain excessively unlikely conditions.

Such extraordinary accidents as that which caused the Caterham outbreak must necessarily be extremely rare; but that particular case is, however, eagerly seized upon as an actual instance in

which the circumstances were such as to preclude the possibility of detecting, by means of water analysis, the impurities which produced the disease. The conclusions which appear generally to be drawn from the history of that case—so thoroughly and ably investigated by Dr. Thorne Thorne—are not always perfectly valid. In the report of the Medical Officer to the Local Government Board for 1881-82 the following passage occurs :—

“ In an outbreak of enteric fever at Caterham two years ago, nearly 200 earlier attacks were traced, upon evidence that did not admit of question, to the use throughout a particular fortnight of water that had been pumped from a well in which a man having enteric fever had been at work. Some excremental matters from him had by accident got into the well. Now I learn, through the Chairman of Directors of the Caterham Waterworks Company, that 1,861,000 gallons of water were pumped from the well during the fortnight. If the water had for the whole fortnight contained one grain of excremental matter per gallon, this would have meant that 19 lbs. of excrement had been added to each day’s supply of water. It is, of course, out of the question that the man evacuated any such quantity ; neither is there any reason to suppose that every gallon received the same amount of contaminating matter ; but the story may serve to show that, in speaking of one grain in the gallon, we speak of a very large amount of polluting matter present in the water. It may be thought of as an amount not likely to have been exceeded in the particular samples of Caterham water that did actually produce disease in the individuals who drank it.”

“ In Dr. Cory’s experiments, then, with one grain of enteric fever-stool per gallon, we see a water thus largely befouled by a most dangerous material ; and the indication of that befoulment, when expressed by the chemist, in terms of albuminoid ammonia, is the figure .014 part per million parts of water. Therefore it is not permissible to accept the doctrines which have been formulated from the amount of albuminoid ammonia present in an otherwise unknown water. Polluting material, potent for harm, may be present in a water “ yielding from .00 up to .05 parts of albuminoid ammonia per million,” without removing it from the rank of waters of “extraordinary organic purity ;” and we assuredly have no evidence, in the case of an unknown water showing from .05 to .10 parts of albuminoid ammonia per million, that it is safe organically.”

With some of the objections raised in this passage we have already partially dealt. It is stated that there is no reason to suppose that every gallon received the same amount of contaminating matter. This certainly is an argument that cuts both ways. Considering recent observations as to the part that *quantity* of poison seems to play in producing enteric fever, on this ground alone there seems to us good reason to believe that some gallons of the water contained very much more than *one* grain of contaminating matter. There is no reason to suppose that the polluting material was equally diffused through the 1,861,000 gallons of water. There is every reason to suppose the contrary, and that in "the particular samples of water that did actually produce disease," the one grain per gallon of impurity is decidedly likely to have been exceeded, and probably very largely exceeded. Again, to speak of one grain of enteric fever *stool* per gallon as constituting a "large befoulement" seems to us to be by no means admissible. A water contaminated to this extent may be dangerously contaminated, but certainly not largely, so far as actual amount of organic matter is concerned. Supposing that the small total amount of poisonous matter had been equally diffused through the Company's reservoir, it would, of course, have been absurd to expect to discover its presence by analysing a sample of water from the reservoir; and in the absence of analyses of "the particular samples of water that did actually produce disease," we venture respectfully to submit that the history of the Caterham case does not in the slightest degree detract from the value of water analyses for sanitary purposes.

With regard to the second point above-mentioned, viz., that discrepant results are obtained when samples containing known quantities of polluting material are submitted to analysis, we have to consider Dr. Robert Cory's extremely able and interesting report of an extensive series of experiments carried out by him with a view of testing the validity and sanitary value of the various methods of water analysis.*

Desiring to find whether analysis really gave results proportional to the amount of impurity present, Dr. Cory prepared samples by adding known quantities of various organic substances, such as enteric stools, healthy stools, urine, and egg-albumen to waters and submitted these to analysis. Dr. Cory made use of Lambeth water to make up his polluted samples. He added the measured quantities of the various polluting materials, and took note of the amounts

* Eleventh Annual Report of the Local Government Board, 1881-82.

of albuminoid ammonia, &c., obtained over and above the amounts present in the Lambeth water itself; that is, he drew his conclusions in part from the *increments* obtained. The results were, in many cases, very fairly proportional to the degree of pollution, more especially in the case of the albuminoid ammonias, but in many there were serious discrepancies, sufficient, at first sight, to throw grave doubt upon the reliability of our present modes of analysis. The following analyses performed by Dr. Dupré are taken from Dr. Cory's Report. We quote experiments in which egg-albumen was used for reasons shortly to be stated.

Name of Sample.	D D Lambeth Water from Cab Rank, West- minster Bridge Road, Feb. 4, 1884.	E E 2,000 c.c. of Distilled Water, to which had been added 2 c.c. of egg-albumen. Pollu- tion=10·15 grains of dried egg-albumen per gallon.	F F 2,000 c.c. of Lambeth Water of Feb. 4, to which added 2 c.c. of egg-albumen. Pollu- tion=10·15 grains of dried egg-albumen per gallon.
Appearance	Clear	Turbid.....	Turbid
Colour	Brownish	Very pale brown- ish	Brownish
Deposit	None	Little, white floc- culent	Little, white floc- culent
Nitrous Acid	None	None	None
Phosphoric Acid	Much	Very strong trace	Very strong trace
Colour of Residue	Light Brownish..	White	Light brownish
Behaviour of Residue on heating	Blackens slightly	Much carbon sep- arated, strong smell of burning nitrogenous matter	Much carbon sep- arated, strong smell of burning nitrogenous matter

Grains per gallon.

	D D	E E	F F
Oxygen absorbed from permanganate	0·134	0·731	0·901
Total dry residue	10·10	10·92	29·4
Consisting of volatile salts	3·36	9·8	11·48
Consisting of fixed salts	16·08	1·12	17·92
Chlorine.....	1·02	0·14	1·16
Nitric Acid	0·26	none	0·06
Ammonia	0·0000	0·0224	0·0101
Albuminoid ammonia ..	0·0112	0·597	0·6587

Dr. Cory's general conclusions as to the value of the Wanklyn and Frankland processes are as follows :

"With regard to the albuminoid ammonia process of Messrs. Wanklyn and Chapman :

"(a) This may be trusted to show which of two samples of water is the more polluted when the polluting material contained in each

is of the same kind; also, in that case, and when the absolute amount of polluting material is not great, it is capable of determining the relative degree of pollution in a number of samples.

"(b) But when the polluting material is in large absolute quantities, a given difference in the extent of pollution is not indicated by a corresponding difference in the yield of albuminoid ammonia.

"(c) Equal amounts of albuminoid ammonia may be furnished by extremely different quantities of nitrogenous polluting material; and, conversely, extremely different quantities of albuminoid ammonia may be furnished by one and the same quantity of nitrogenous polluting material; and this is the case even though the polluting substances differ no more *inter se* than one typhoid stool differs from another typhoid stool. When a typhoid stool is compared with a healthy stool, obtained under somewhat similar conditions of diet, water polluted with the healthy stool yields to this process a larger amount of albuminoid ammonia than water polluted with the same quantity of typhoid stool.

"(d) The classification of waters, given by Messrs. Wanklyn and Chapman, in their work on Water Analysis, is calculated to mislead in a very dangerous way. 'Drinking water,' it is there stated, 'falls into three classes, according to the degree of organic purity;' and Class I comprises 'Water of extraordinary organic purity, yielding from .00 up to .05 parts of albuminoid ammonia per million. Water of this class cannot be objected to organically.' Yet the pollution of a gallon of water by all the soluble and finer particulate matter from 3·5 grains of typhoid stool, is represented, in Mr. Wanklyn's own hands, by no greater increment than .02 parts of albuminoid ammonia per million of water."

As regards the process for determining organic carbon and organic nitrogen, Dr. Cory seems to be of opinion that it achieves what it professes to achieve rather more satisfactorily than is the case with the other processes. He says (p. 158), "It would not be wise to generalise much from the results of two analyses, but having regard to the intentions of the method, it is probably permissible to form a judgment on it without any great variety of experiments, and the impression conveyed to me by the results of these processes for the determination of organic carbon and organic nitrogen is to prefer them to the processes which aim at bringing into simpler combinations the various elements of organic substances, and at deducing the quantities of these substances from the quantity actual or inferred of those combinations."

Some of the analytical results in Dr. Cory's report seemed so much at variance with the generally held opinions as to the merits of water analysis, and with previously published results by Mr. Wanklyn and others, that we were led to examine the details of the experiments, and more particularly as regards the Wanklyn process, which is chiefly dealt with in his report. All previous evidence seemed to be in favour of accuracy. It is well known that very exact and concordant results are usually obtained by different analysts in examining the same water, and that repeated examinations of the same water are also very constant, the periodical examinations of the London drinking waters furnishing an example. Moreover Mr. Wanklyn's results in his experiments with different nitrogenised bodies, treated by the alkaline permanganate process, are most satisfactory. There is, further, Dr. Fox's evidence, previously referred to, as to the concordance of opinion based on independent analyses made by both the Wanklyn and Frankland processes.

If the polluting agent is *uniform in composition*, and uniform in diffusion, if the re-agents are standardized and in proper proportional quantity, and if the same treatment is applied in all cases, then it seems obvious that, whatever portion of the pollutant in one case is acted upon by the re-agent, an exactly proportional part of the same pollutant in another case will be acted upon in the same way and to the same extent.

In some of these experiments this does not seem to have been the case, and it remains to be seen if the failures were due to absence of some of the essential conditions, or to radical imperfections in the methods of analysis. The amounts of ammonia obtained were, in some cases, small, but this does not affect the question, inasmuch as the object in view in most of these experiments was to test the process as regards its capability of yielding results proportionate to the amount of pollution.

As regards the polluting substance it is to be remarked that only a small portion of the enteric stool, for instance, is *solid matter*; only a part of this solid matter is nitrogenised, and only a part of the nitrogen present may come off as the ammonia which, in the Wanklyn process, forms our index of pollution. The ammonia yielded is not an absolute measure of the bulk or weight of the polluting ingredient, nor of the solid matter in it, nor of the injurious and dangerous properties of such matter, but simply a *measure* of the nitrogen present in organic combination, and hence of the pollution. It does not profess to tell us the absolute amount

of the nitrogenised matter, nor even the amount of the nitrogen in organic combination, as is the case with the combustion process ; but we venture to maintain that it does present a constant proportion for varying quantities of the same pollutant.

We may here quote the following passage from one of Mr. Wanklyn's essays on the subject.

"Acetic ether may be made to yield acetic acid quite quantitatively, and in whatever sense the carbon contained by acetic ether can be said to be a measure or index to the acetic ether, in the same sense the acetic acid is a measure or index to the acetic ether. An unknown mixture of acetates could not be absolutely measured by the carbon it contains, neither could the mixture be absolutely measured by the acetic acid which it gives. But in whatever sense the carbon can be said to be an approximate measure of the mixed acetates, in that same sense is the acetic acid a measure. For acetic acid read albuminoid ammonia, for acetic ether read albuminous substances, and for mixed acetates read the miscellaneous nitrogenous organic matters in drinking-water, and the parallel is complete."

The process is designed to determine whether a water is or is not passable, acting upon a standard based on experience. The limit generally admitted in the case of albuminoid ammonia is 0.15 parts per million, and a water which yields anything approaching this amount is to be looked upon with very great suspicion. This limit was fixed upon, after a long series of experiments, as representing the maximum yield of albuminoid ammonia in waters which were known to be uncontaminated. A limit of some kind, determined in a similar way, must, of course, be used in any process. If, therefore, we find more than .15 parts per million of albuminoid ammonia, we conclude that there has most probably been organic pollution ; and as this may be, or may at any time become, dangerous, we condemn the water. And it may be further stated, as an almost invariable rule, that other analytical evidence will be found to confirm this conclusion. It is true that in some rare cases a water fit to drink may yield more than .15 per million of albuminoid ammonia, and that other analytical results are negative ; but the condemning of such water occasionally is of immeasurably smaller importance than the passing of a single one that is impure. If we find, on the other hand, less than .10 parts per million of albuminoid ammonia, it is reasonable, other evidence to the contrary being absent, to conclude that the water is unpolluted ; inasmuch as, for such a water

to be polluted, it is necessary to assume, firstly, that it was originally of very exceptional purity, and, secondly, that the pollution had taken place to an extent far slighter than occurs in almost every case where there has been any pollution at all.

It is hardly fair in dealing with quantities widely differing from those generally met with (for which the process is devised) to expect very close agreement of results, just as it would be unreasonable to expect a chemical balance to weigh pounds or fractions of milligrammes with as much accuracy as it weighs grammes and decigrammes. Further, a process which is capable of differentiating with accuracy between say two and three parts—whatever unit be taken—must not be considered as invalid if it fails to distinguish equally sharply between 52 and 53. An error of 1 would in the first case be fatal, amounting to 30 or 50 per cent. ; whereas, in the other, it would be an error of only 2 per cent. We must, therefore, not expect to measure minute *increments* in presence of a large quantity (even if accurately known) of other impurity, which also yields the same measuring product.

Passing now to the consideration of Dr. Cory's experiments, it seems to us that some of the above remarks apply with a certain amount of force. Fæcal matter is the first material used. In some of the experiments its amount was determined by *weighing* a known quantity in its normal state and polluting water with it. Here we have, evidently, no guarantee of uniformity. This difficulty being at once obvious, in another case the total solid constituents of the fæcal matter were determined ; and in yet another the amount of soluble constituents, because the water for analysis was only taken after it had been allowed to stand and deposit suspended matter. We are not told that a separate determination was made in each case, but doubtless this obvious precaution was observed, as there is no ground for assuming constancy of composition between different stools, or even constancy of composition in *the same stool*. The polluted water having been allowed to stand and the deposit ignored, and the more or less clear supernatant liquid analysed, it is scarcely possible that it would have had any very constant composition ; at all events not in relation to the original weight of pollutant added. And as the object of the experiments is to find whether the results are proportionate to the impurity present when equally diffused, not to determine if the water is or is not polluted, there seems little to be gained by using a pollutant so difficult, if not impossible, to diffuse uniformly, although it has, of course, the advantage of being a most common and dangerous source of contamination.

We next come to urine, obviously far better as regards diffusion. The nitrogen is present in urine chiefly in the form of urea, which is with the greatest ease converted into carbonate of ammonia. In the case of urea Mr. Wanklyn points out that no free or albuminoid ammonia is obtainable, urea being, in a sense, a completely oxidised body. If the urea be decomposed into carbonate of ammonia we should, of course, obtain the nitrogen as "free" ammonia. On p. 135 of Dr. Cory's report we find that 3.094 grains per gallon of urea in Trafalgar Square water gave no increment to the total dry solids, although it did so in distilled water. Doubtless this had ceased to be urea by the action of the ferments in the dirty water used.*

The results with urea depend upon the water to which it was added; this, if dirty, will cause the more or less rapid transformation into ammonic carbonate. In actual practice, where we have urine pollution, this transformation has already taken place. The impurity is no longer urea, and we obtain a large amount of "free" ammonia. Here again, then, the conditions were scarcely well chosen. If the proportional result is to be obtained from urea as urea, we must not use impure waters, and must look for only minute traces of ammonia from it; and while it is in process of rapid change to carbonate of ammonia it would be vain to expect uniformity of composition or uniformity of result.

With egg-albumen many of these criticisms lose whatever force they may be thought to have in the preceding cases. If the albumen is uniformly mixed with water and well filtered, we have a fairly constant diffusion *for the time being*. We have found, however, that even after repeated filtration such mixtures are opalescent, and that diffusion is by no means perfect. Where Dr. Cory has used albumen his results are, as a rule, also fairly satisfactory as regards the albuminoid ammonia. We deemed it advisable to make a few experiments with albumen solutions. The fact is first to be noted that the albumen solutions change, and change very rapidly—if allowed to stand they lose weight by evaporation, become turbid, and decompose—but albumen seems, nevertheless, to be the most suitable of the materials used by Dr. Cory. Great care was required to overcome the liability to error from coagulation of the albumen and its consequent adherence to the sides of the distilling flask. This, by the bye, does not, in our experience,

* As the "free" ammonia was not high, and the albuminoid ammonia was very high, it follows that the urea had not become ammonic carbonate, but had passed into some condition in which it yielded albuminoid ammonia. There seems to be some error here.

seem to occur in ordinary water analysis, *i.e.* the albuminous matter even in the very worst waters, *e.g.* in effluents from sewage, does not behave in a similar way. Some of the results we have obtained with albumen solutions are as follows:—

Sample A.

2 c.c. egg-albumen solution + distilled water, free from ammonia to half litre.

Albuminoid ammonia, 0·756.

Sample B.

4 c.c. same albumen solution + distilled water, free from ammonia to half litre.

Albuminoid ammonia, 1·47.

In these cases the pollution was obviously very large.

Sample C.

1 c.c. egg-albumen solution + distilled water, free from ammonia to half litre.

Albuminoid ammonia, 0·294.

Sample D.

0·5 c.c. egg-albumen solution + distilled water, free from ammonia to half litre.

Albuminoid ammonia, 0·156.

Sample E.

2·5 c.c. albumen solution + distilled water, free from ammonia to half litre.

Albuminoid ammonia, 0·338.

Sample F.

5·0 c.c. albumen solution + distilled water, free from ammonia to half litre.

Albuminoid ammonia, 0·662.

(Results stated in parts per million.)

The albumen solutions were different in each of these three sets of comparative experiments, and were all more or less decomposed. The other results we have obtained we propose to lay before the society on a subsequent occasion.

It will be seen that the figures are in no case far wide of the actual proportions present, which, we may add, were in all cases unknown to the analyst. It has always been our experience in

working the ammonia process that whenever it has been necessary or advisable to analyse the same sample two or more times—a thing which very often occurs—having either the same or different quantities of the samples for the repeated experiments, the amounts of ammonia obtained have been equal when equal quantities were taken, and proportional when the quantities were different.

How is it, then, that in some of Dr. Cory's albumen experiments the results obtained show serious discrepancies? We would suggest that the explanation probably is that the quantities to be measured were often widely different from those occurring in ordinary waters, and that they were determined in an impure water which itself yielded a large quantity of albuminoid ammonia on analysis, and, in the case of the earlier experiments, uncertainty as to the proportional pollution.

So far as the evidence before us goes, there seems to be no good reason to doubt that we can and do thus obtain valid evidence of the degree of impurity of water.

As regards the cultivation processes, which are somewhat prematurely credited with the capability of altogether supplanting present methods of analysis, it is well known that practically all waters are found to contain organisms, the commonest of which are the easiest of cultivation. It is asserted that by a cultivation process carried on in a 5 per cent. solution of previously sterilised gelatine, or other nutrient substance, the presence of sewage can be demonstrated by the differences in the naked-eye characters of the spheres which form in the matrix. But even if this be so, it merely forms an additional test for the detection of sewage—a detection which is already satisfactorily effected by other processes; and it cannot, therefore, supersede these unless it can be shown to afford a means of distinguishing between specific and comparatively harmless organisms. Whatever future success there may be in store for the cultivation processes, at present they can tell us absolutely nothing of the presence or absence of specific organisms or specific poisons of any kind.

Dr. Cory concludes the report to which we have referred by the statement, previously quoted, that he prefers the Frankland or combustion process; and he considers that, "having regard to the intentions of the method," this preference is sufficiently justified by the results of two analyses made by it, which showed with a considerable degree of accuracy the amounts of polluting material which he had added to the waters, and the ratio of organic carbon

to organic nitrogen, with a close approach to the truth.* But the results of the Frankland process yield no more information as to the dangerous character of the organic pollution than do the results of any other process. The distinction between animal and vegetable organic matter is made out with as much certainty by the ammonia process properly worked, and duly accompanied by other analytical evidence, as by a study of the ratio of organic carbon to organic nitrogen; and although as regards the Frankland process everybody must unquestionably admire the great ingenuity and skill which have been brought to bear in the development of that truly beautiful analytical method, yet the sanitarian has not much, if anything, to gain by making use of it. The conclusions arrived at are reached with equal certainty by far more easy and rapid means, and consequently one cannot help thinking that a very large amount of scientific skill and labour is unnecessarily lost in using the process for sanitary purposes.

We contend that, as regards either evidence or criticism, nothing has as yet been brought forward that seriously minimises the enormous value of water analysis in sanitary science. Whether we "go beyond the laboratory" or not, we shall arrive at no method of investigation whose results will justify us in speaking of a water as absolutely safe. Absolute safety is unknown and unknowable.

The President, after thanking the authors of the paper in the name of the Society, dwelt upon the importance of ascertaining the wholesomeness of waters.

Dr. Thursfield regarded water analysis as a double-edged weapon; he had known cases in which the water was shown by the most conclusive evidence to be the cause of enteric fever, and yet as the result of chemical analysis, in the hands of a competent analyst, it had been stated to be perfectly good.

Dr. Thomas Stevenson thought chemical analysis must always be open to some doubt; evidence of much pollution was easily obtained, but small amounts of specific matter were not recognisable. Microscopic examination was not very reliable; the sewage fungus had also been found in warm sulphur springs.

* We may point out that in Dr. Cory's urea experiments (p. 135 of the Report), 3.094 grains per gallon of urea yield no increment to the total solids when dissolved in Trafalgar Square water; so that the urea has been decomposed and dissipated. Inasmuch as the taking of a dry residue is the first step in the Frankland process, such a quantity of urea would, therefore, fail to be detected by it.

Mr. Wynter Blyth said too much value should not be attached to any one method; in addition to chemical analysis, he always submitted waters to the biological test. Sewage fungus can always be developed in from twenty-four to forty-eight hours in sterilised syrup; it is never absent in impure water, but sometimes present in pure. He described the method of estimating the wholesomeness of water agreed upon by the Society of Public Analysts—viz., giving a definite value to the appearance, odour, microscopical characters, chlorine, nitrates, &c., of water.

Dr. Tripe noted that chemical analysis failed to discriminate between harmless and injurious organic compounds, and gave an account of an outbreak of diarrhoea produced by water in his district. In this case Mr. Wigner found mycelium threads in the water; he thought sufficient value did not attach to microscopic evidence. As to the Caterham case he fully agreed with the authors of the paper in their criticisms on the conclusions drawn in the Local Government Board report from the history of that case.

Mr. Shirley Murphy expressed surprise that the Society of Public Analysts should have approved the method described by Mr. Blyth, and characterised it as unscientific.

Dr. Edmunds said that waters were of three classes, one so much polluted that the nature of pollution did not matter; the second appeared pure, but yielded a tolerable quantity of albuminoid ammonia, and, when tinged with permanganate of potash, the colour remained unchanged for many hours; here the water might be accepted. The third was not obviously polluted, but would not stand these tests, and, if dangerous, the organic matter was living germinal, and of a particulate character. The microscope would only be of service if it would settle this point.

Mr. Cassal and Dr. Whitelegge in replying, insisted on the making of full analyses, and on the importance of microscopic examination, partial examinations were worse than useless. They contended that no case whatever could be cited where a water having been shown to be the cause of enteric fever, had been passed as good and pure after a complete hygienic analysis. Many people appeared to think that a water having once been analysed and passed as good had thereby received a kind of insurance against subsequent pollution.

“Notes on Some Suspicious Cases of Copper-Poisoning.” By G. H. Fosbroke, M.R.C.S., S. Sc. C. Camb., Medical Officer of Health to the Stratford-on-Avon Combination of Sanitary Authorities.

Considerable prominence having lately been given to the question, “whether or not copper accidentally introduced into our food may result in disastrous consequences,” I feel constrained to bring to your notice my “Notes on Some Suspicious Cases of Copper-Poisoning.” In May last I was informed that “diarrhoea” was prevalent among the inmates of an union workhouse, situated in an agricultural district, and was requested to inquire into the matter. I visited the institution with as little delay as possible, in company with the medical officer in charge, and took the necessary evidence. In doing so, however, considerable difficulty was encountered, as the superintendent was an unwilling witness. At the date of my visit there were 123 persons residing in the building, and among them, I was informed, “diarrhoea” had been most persistent. On the day of my inquiry seventeen patients were under treatment, four of them were adults, the remainder children. The symptoms of the illness complained of were lassitude, headache, constant thirst, disagreeable taste in the mouth, loss of appetite, vomiting of green matters, purging more or less severe, the stools being dark coloured, pain in the stomach and bowels of a crampy character, and in some cases general through the body, coldness of limbs, great exhaustion, and convulsions in one or two instances. Jaundice was well marked in a child who died; indeed the infirmary nurse, a woman of considerable experience, when speaking of this corpse, said “she had never seen such a body.” At an early stage of the inquiry I observed that the patients were not drawn from any particular class of the paupers, and, consequently, did not usually spend their time in any special set of rooms or part of the workhouse. It very soon became obvious that the different illnesses commenced either during the evenings, or in the course of the night of Wednesdays or Saturdays. When seeking the cause of the mischief I naturally directed attention to the sanitary state of the institution. In August, 1876, I was instructed to report upon this subject, and in consequence of the representations I then made, the whole of the old drains were taken up and new ones relaid, modern improvements being introduced. The sewage was disposed of by “irrigating” a field, distant at least a quarter of a mile. When I held my inquiry last May the drains proved to be in fairly

good working order ; at the same time I am bound to say that the flushing arrangements were slightly out of gear, in consequence of the sluice valves having been allowed to get out of repair. These defects, however, were not material. The excrement disposal of the workhouse was effected through the agency of "trough latrines," "pail-closets," or "water-closets." The "trough latrines" connected with the drains formed detached buildings in the various court-yards, and were cleansed through the medium of "rain-water tanks"; both they and the "pail-closets" were cleared of their contents every day. Only one or two ordinary water closets were in use, and their position excluded them from any association with the illness. A well on the premises acted as the source of the water supply ; the water being pumped therefrom to a tower, and distributed by leaden pipes. Searching inquiries convinced me that on the day of my visit, and for some time previously this was not polluted either at its source or in its transit through the pipes. In short, I failed to attribute this outbreak of disease either to bad drainage, unsatisfactory refuse disposal, or contaminated water. I next turned to the milk supply, but was speedily able to eliminate it from consideration as I found that several of those attacked never used it ; besides, its quality was good, and its method of storage unexceptional. At the outset of the inquiry I was struck with the fact that the symptoms of the illness I was investigating were not the ordinary ones met with where insanitary conditions play an active etiological part ; nevertheless, I did not exclude such causes from consideration until I was compelled to do so. I have already said that the patients sickened either during the evenings, or in the course of the nights of Wednesdays or Saturdays. Scanning the dietary tables in use, I found that the food consumed on those days was not partaken of upon other occasions. I ascertained that the meals supplied to the paupers consisted of breakfast, dinner, and supper. The morning repast was similar each day of the week. Those classified as "able-bodied" had bread and gruel ; the "aged and infirm," bread, tea, and butter ; and the "children," bread milk, and oatmeal porridge. For dinner, cooked meat and vegetables were supplied on Sundays, Tuesdays, and Thursdays ; soup on Wednesdays and Saturdays ; and suet pudding on Mondays and Fridays. For supper the "able-bodied" received bread and cheese or bread and broth ; the "aged," bread, tea, and butter ; and "the children," bread, milk, and butter, or dripping.

You will have noticed that the breakfast and suppers differed but

slightly from day to day, and that the dinners varied three times a week. As the patients sickened on Wednesdays and Saturdays, I naturally carefully examined the dietary tables for those days first, and found that all persons affected took soup. Pursuing my investigations in this direction still further, I learnt that such food was composed of the following ingredients. Raw meat, split peas, or Scotch barley, oatmeal, fresh vegetables, bones, meat liquor, dried herbs, and seasoning. The soup was prepared in a copper furnace (which I may add, had never been lined with tin), and of course required to be "simmered" for several hours before it was consumed. Examining this furnace, I found it was devoid of all characteristic metallic appearance, and was covered with incrustations to such a degree that scraping with a knife, or even friction with a towel, readily detached the coatings; evidently the utensil had not been thoroughly cleansed for weeks; indeed it is questionable if it had been properly scoured for a much longer period. The filthy state of this culinary vessel having been established, I next inquired as to the wholesomeness of all articles of diet; and ultimately came to the conclusion that, with the exception of the soup, neither they nor their mode of preparation excited suspicion. In the course of my investigations I elicited that pork had occasionally been substituted for the beef and mutton ordered by the guardians. I do not, however, think that any of the meat consumed was either diseased or tainted. The contractor who supplied it lived in a small country town, and very near to the local sanitary inspector—a most vigilant officer—so the chance of unwholesome meat finding its way to the workhouse was, I believe, remote.

The medical officer and I, after weighing all the evidence we obtained, came to the conclusion that the illness we were investigating had been brought about by the soup having been prepared in a foul copper furnace. Unfortunately, I was precluded from submitting any of it to analysis, as none was accessible on the day of my inquiry. Neither was a *post mortem* examination of the body of a child who died possible, for at the time of my visit it was buried. This is greatly to be regretted. As soon as it became known that the dirty state of the furnace would be called in question, the official blameable for the neglect took steps to eliminate all trace of his carelessness, and from that hour "the plague ceased," indeed there has not been a single fresh case of a similar nature in the institution since then, although the sanitary arrangements (until within the last week or two) remained absolutely the same.

I frankly admit that the presence of copper in the soup not having been proved by analysis, the evidence on which I attributed the illness to the use of food cooked in a dirty copper vessel was of a negative character. I think it will be allowed, however, that events afford substantial support to the accuracy of my views. I should not have ventured to obtrude these remarks upon you had I not seen that latterly there has been a tendency, more especially among French observers, to favour the idea that copper introduced into food does not constitute a public danger. It has long been known that the green colour of preserved vegetables is sometimes imparted to them by salts of copper, and although attempts have been made to prove that that process may be carried on with impunity, yet I believe it is generally believed to be an injurious one. A report presented by M. Galippe to the Paris Society of Public Medicine in 1879, supports the view that copper salts introduced into our food in this way are harmless, and states that there is no reason for interdicting the colouring of preserved vegetables by sulphate of copper. The Council of Public Hygiene in Paris, however, do not appear to favour this idea, since they have forbidden the use of these salts in the most peremptory manner possible. I may mention incidentally, that about nine years ago my attention was directed to the fact that six or seven guests at a private dinner table had manifested symptoms somewhat similar to those just spoken of; suspicion attached itself to a particular bottle of port wine, and ultimately it was found, after consulting an eminent analyst, that this wine contained cupric sulphate. Copper in its metallic state is said not to be poisonous, but as viands containing fatty or saline matters, when cooked in copper vessels, dissolve some portion of the metal, I think such utensils should not be used for such a purpose. I am aware that large quantities of food are prepared in copper vessels, but I am sure that I need not remind you of the numerous instances of chronic poisoning which have been traced to their use. When kept perfectly clean, such utensils appear to be harmless, as the metal is readily eliminated by the excreta, but when neglected the case is very different. I feel that the dangers attendant on the use of dirty copper vessels are not sufficiently appreciated.

In the discussion which ensued, Professor Gardner observed that copper vessels are usually lined with tin, and are then the best for cooking purposes, but when not so lined become dangerous when free acids are eliminated, or when exposed to grease and air.

Mr. Wynter Blyth asked whether the patients had a green line round the gums. Corroded copper would be readily attacked by broths which are acid, and thus poisoning results; but he was rather sceptical as to the injurious effects of vegetables coloured with copper.

"Cursory Remarks on the Manufacture of White Lead, and its Effects on Health." By F. M. Corner, M.R.C.S., Medical Officer of Health, Poplar.

My mention at a meeting of this Society, on Jan. 18, of two fatal cases of lead poisoning which came to my knowledge, elicited from our President the request that I should supply further details, as the matter was of considerable importance and interest.

The two cases occurred about the same time, and were those of women, both of whom had worked in the same factory.

The first was a girl, whose age at her death was 18 years and 3 months. She was described in a note made towards the end of November as cleanly in her appearance, with colour in her cheeks, and in good health; the only sign of plumbism being a slight blue line on the margin of the gums. She had been working on and off at the factory for twelve months. In the autumn she worked in the hop-fields, returned home in September, and resumed factory work in the middle of October. Her mother and sister, who work in the same factory, state that she had always enjoyed good health, had never suffered from symptoms of lead poisoning, and on the morning of her last visit to the works she appeared as well as ever. At breakfast-time she was taken ill, and removed to hospital, her condition on admission being rather puzzling. She appeared unable to give any description of her feelings, and her behaviour was more suggestive of hysteria than anything more serious. The interval between her admission and death was four days, during which she never recovered consciousness, had several slight epileptic attacks, and appeared to have died in one.

At the time of her being taken ill she had been working in the white bed, unstacking the bed, on the completion of the process of white lead formation. An autopsy revealed no changes in the nervous system, and in the large bowel only some slight discolouration.

The second case was that of a married woman, between 30 and 40, of delicate constitution, who had had two children, and had been engaged in the lead work about ten months. After four months she was obliged to stay away for a fortnight from sickness, constipation, pain in the chest, and giddiness. In September she again suffered from giddiness, faintness, pains in the head, and loss of appetite, and was advised not to continue the work. In October she reported herself better, and continued her work. In November she gave a like report, but was remarked on as "pallid." The following month she had been taken into hospital, suffering from plumbism, having foul tongue and breath, the lead line on the gums, occasional but severe colic, vomiting, and slight loss of power in the right wrist. There were also symptoms indicating disturbance of brain similar to, but rather more severe than, those previously suffered. Four or five days before her death she had in the night a fit, of only a few minutes' duration, but which, from the nurse's description, was epileptic in character. Other attacks followed, and in the end coma and death. At the autopsy absolutely nothing was found, except some staining of intestine; but an analysis of the viscera discovered in the liver 3·5 grains of lead, and more in the nervous system. There was a close similarity in the nerve symptoms in the two cases. In both, the convulsive attacks, while in hospital, were slight; both occurred in the night, and were only observed by the nurse.

In the first case it would seem that no amount of inspection could have detected the near approach of fatal symptoms, as no premonitory warnings appear to have occurred.

In the second there had been evidence of brain disorder, but the woman had recovered, and nothing in her condition when seen about a month before the fatal illness suggested that she should be advised to discontinue her work.

The common effects on nearly all the employés in white lead factories—nearly all of whom are women—are a general failure in health, as evidenced by their pale complexions, loss of appetite, pain in the pit of the stomach, aggravated often by food, constipation, colic, pains in the limbs, paralysis, more particularly of the extensors of the wrist and hand, sometimes of the muscles of expression, and the deadly effects of the poison on the nervous system, ending in convulsions and coma. It is a common practice for these women to absent themselves when feeling ill for a few days—weeks—months—generally taking active aperient medicines. Some con-

tinue work to the full period of utero-gestation and during suckling, and in answer to questions, appear not to have suffered from the habit. I have not met with confirmation of the opinion that lead-poisoning leads to abortion, but I have been struck with the large proportion of childless married women.

The process of manufacture appears almost identical in the larger manufactories, and may be briefly given in the illustration of the dangers to health under which the employés work, in spite of every care on the part of the employers, and the well-intentioned regulations made obligatory under the Factory and Workshop Act, 1883.

The melted metal is lifted in ladles from a cauldron and run into shallow moulds, setting almost instantly, and is then taken to a chamber to be stacked. The stack is formed first by a layer of tanner's bark, upon which are placed rows of earthen pots filled with vinegar; over these are ranged the moulds of lead, and layer on layer of these are built up, until the chamber is nearly filled. Building up the stack is known as working in the blue bed.

The removal of the stack, generally after three months, when the lead is found largely converted and encrusted with white lead, is termed working in the white bed. The stack is carefully taken to pieces by the hands of women, water being sprinkled about for the purpose of lessening the rising of the white lead dust. The white lead frames are carried in trays, generally on the heads of the women, to the water tanks in which they are raked over and the white lead detached from the unconverted metal. It is then ground either in the wet state, during which no dust is generated, or in the dry state, when much dust is diffused.

For the purpose of drying, the wet salt is put into ware dishes and placed on shelves in the stoves, and submitted to a dry heat at a high temperature.

The next step (after about three weeks) is the drawing of the stove, the dishes being handed down from the shelves and passed from one woman to another, forming a line of workers, to the bin or barrels into which the contents are turned.

It is believed that little or no danger attends the handling of the blue metal or lead, and that the first serious danger is experienced in the removal of the stack or the white lead, the Act requiring provision of a respirator for the mouth and nostrils to every person so occupied. Unfortunately the work is heavy, heating, and dusty, and scarcely a woman can submit to wear the respirator. It shuts out the air, causes greater heat and fatigue, has to be frequently

removed by hands covered with white lead dust to allow of their spitting out the saliva impregnated with dust, which otherwise must be swallowed. In practice it is generally seen round the neck, and not on the mouth or nostrils, the women preferring to keep the mouth closed as much as possible, and to spit out without hindrance.

The same remarks will apply to the work of drawing the stoves and the conveyance and deposit of the dry white lead in the bins and casks. It is a department in which there is considerable muscular exertion, and during which the respirator cannot be worn, but the overall and head covering also provided under the Act can be and are used.

At the tanks the hands and arms become covered with white lead deposit left after drying off of the water.

An overall and head cover are required by the Act, and I cannot give any opinion on the effect to health of the exposure of the hands and arms.

The weak points in the present system of manufacturing white lead are the great amount of manual work, the exposure of the work-people—nearly all women—to an atmosphere largely charged with white lead dust, and, in separating the salt from the lead frames, the exposure of the hands and arms to the same poison whether dry or suspended in water.

The regulations under the Factory Act have, I believe, produced habits of greater cleanliness, and some benefit has resulted from the use of overalls and head covers, but the use of the respirators has been found impracticable.

Until an improved method of manufacture is substituted for the one now in use, my opinion is that none of the so-called safeguards against injury to health will avail much, and that we shall still have in the operatives the general run of complaints so often met with, and the occasional, though I suspect not very rare, instances of death from poisoning of the nervous centres.

That white lead can be manufactured otherwise and in large quantities is shown by the electric process seen at Professor Gardner's works, Deptford, in which the aim has been to save time, to dispense with manipulation and washing of the white lead, and to save pollution of air by white lead dust. All these points are asserted as having been achieved, but the commercial success has, I believe, yet to be proved.

The aims are what all sanitarians will approve, and what is now

needed is a fair trial of the produce of Professor Gardner's method with that made by the old system.

Professor Gardner described his process of manufacture of white lead by which one-sixth of the time occupied by other methods is saved, and the creation of dust avoided.

Mr. Wynter Blyth then asked if the author of the paper had noticed any signs of mental weakness among workers in lead factories. About the year 1830, Tanqueril had described an affection called "*Lead encephalopathy*," and recently the English chemists, especially Dr. Rayner, of Hanwell, had called the attention of the profession to lead as a factor in the causation of insanity. Mr. Blyth had been afforded the opportunity of seeing at Hanwell several cases in which the cause of the disease either remotely or directly was supposed to be "*lead*." All the cases were characterised by illusions of the senses; especially of sight and hearing. He would also like to ask whether any effect either in parturient women had been observed, or in the subsequent life of the offspring.

"*The Fallacies of Empirical Standards in Water Analysis as told by the Story of a Polluted Well.*" By Alfred Ashby, M.B., Medical Officer of Health and Public Analyst for Grantham, &c.

Some months ago I had occasion to analyse some water from a well sunk in the variegated marl of the Trias, and found, in 100,000 parts, chlorine 7·0, nitric acid ($N_2 O_5$) 5·0, sulphuric acid ($S O_3$) 5·2, phosphoric acid very heavy traces. Total solids 51·0, free ammonia ·0009, albuminoid ammonia ·0055. If I had judged the water by Mr. Wanklyn's standards it would almost have come under his class 1, "water of extraordinary organic purity." But it only just overstepped the bounds and would have entered his class 2, which he says are waters "safe organically."

However, I neglected these empirical standards, and judging it by the ordinary accompaniments of sewage it contained I pronounced it impure.

The owner then had the well, which supplies a house in a village, remote from other premises, opened and examined. On examination, the lining was found to be of dry laid bricks and to be very defective. The well is 3 feet 6 inches in diameter and 35 feet deep.

It is sunk first through a bed of clean, red gravel, of which I produce a sample. The brick lining is 17 feet deep and extends into the hard red marl which continues to the bottom of the well. There were 13 feet of water in it. Top water from the gravel bed continually drops through the lower part of the lining, but the main supply flows in rapidly at the bottom through the lower 7 feet of the red marl. Near the bottom of the lining on the north side was a black patch in the defective brickwork, about 2 feet square. From behind the bricks, at that spot, the black discoloured gravel which I now produce was taken.

Thirty feet from the black patch in the lining was a cemented cesspool, into which the drain from a water-closet emptied. It appeared for the most part to have been well made, but there was a leak at the junction with the outlet pipe, through which sewage had plainly percolated. The cesspool had been nearly emptied before I commenced my examination.

The drain from the soil-pipe passed within six feet of the well on its way to the cesspool. Eleven feet from the west side of the well there was a common privy with a large vault, which had not been emptied since it was made about six years ago. The contents were abominably offensive. The back of the vault was 17 feet from the well, and at that part it was evident that its filth had been soaking into the gravel. There was also a small cesspool for the kitchen sink two feet from the well, and the drain from it passed close to the latter. I determined the chlorine on the spot in the water taken from the drippings through the well lining at the black patch opposite the cesspool, from the west side opposite the privy, from the south side and from the east side. The quantities per 100,000 parts were as follows: West side, 8·4; black patch, 6·4; east side, 5·76; south side, 5·4. On the previous day the water from the black patch had 7·0 chlorine in 100,000, which shows it was of variable constitution.

The gravel water would naturally have the same composition all round the well, so the chlorine may fairly be considered to have indicated the relative degrees of impurity of the surface water that was dripping in at the several spots indicated.

It was clear, then, that at the time I examined the well the greatest pollution was taking place on the west side opposite the privy vault, next at the black patch, opposite the cesspool, which had been just previously emptied; then on the east side, and lastly on the south side.

To place it beyond dispute that the privy vault had leaked and had allowed impurities to soak into the well, I had a large quantity of rock-salt put into it and had it filled with water. About twenty-eight hours afterwards a sample of the drippings from the well-lining on the west side showed an increase in chlorine from 8·4 to 11·3, or about 3 in 100,000 parts. There can be no doubt, therefore, that there had been a free passage for filth from the privy to gain admission into the well.

The analysis of this water, taken before the salt had been put into the privy, gave the following results in 100,000 parts:—chlorine 8·2, nitric acid 5·7, sulphuric acid 8·6, phosphoric acid, v.h.t., total solids 56·0, free amm. ·0323, alb. amm. ·0282.

The composition of water collected from the black patch was:—chlorine 6·6, nitric acid 19·4, sulphuric acid 6·8, phosphoric acid v.h.t., total solids 72·6, free amm. ·0018, alb. amm. ·0167 per 100,000 parts.

The well was then pumped empty, when I descended, and took a sample of water as it issued from the red marl, about two feet from the bottom. For the purpose of excluding the possibility of any admixture of the top water which was continually dripping down the sides of the well, I inserted a piece of pipe about nine inches into the marl, and plugged it in with clay. I was in that way able to collect from the free end of the pipe a sample of water exactly as it flowed from the marl; and found on analysis that it contained per 100,000 parts—chlorine 6·1, nitric acid 7·5, sulphuric acid 3·2, phosphoric acid v.h.t., total solids 52·4, free amm. ·0016, alb. amm. ·0079. It had a temperature of 49° F.

These results were somewhat inferior to those I had obtained when I first analysed the well water. I think this may be accounted for thus:—About fifty yards from the side of the well the bottom sample was collected from, there is another well sunk into the same geological formation. It is by some stables which are drained into a cesspool; the drain passed close by it, and had become completely blocked up. In close vicinity also are a common privy and a large manure heap on which pigs dwell. Its water yielded on analysis per 100,000 parts chlorine 5·9, nitric acid 17·6, sulphuric acid 10·8, phosphoric acid v.h.t., total solids 108·1, free amm. ·0007, alb. amm. ·0113. The house well having been pumped dry, there was a strong inflow from the marl, so much so that the pump had to be worked pretty constantly to keep it down. Some of the impure stable well water would thus be drawn into it mixed with the purer water in the intervening length of marl.

In order to ascertain, if possible, the natural composition of the water from that particular stratum, I analysed some from a well about a hundred yards off; it being placed by a house which stands by itself in large grounds. This water contained in 100,000 parts, chlorine 1·6, nitric acid 4·6, sulphuric acid 3·3, phosphoric acid v.h.t., total solids 31·9, free amm. ·0013, alb. amm. ·0188. Another well near to this on the same premises yielded chlorine 3·0, nitric acid 5·5, sulphuric acid 3·5, phosphoric acid v.h.t., total solids 37·6, free amm. ·0016, alb. amm. ·0133 per 100,000 parts.

The water named last but one, although not above suspicion as to its purity, may be taken as showing the composition of the best well water that can be obtained in that neighbourhood, and it will be observed that though its organic matter is higher than in the well water so often referred to in this paper, nevertheless the usual sewage accompaniments in it are less.

These analyses and facts have plainly established the assertion that some of the water that was flowing into the well under consideration was highly polluted, and that the water taken from it was capable, as occasion arose, of conveying the specific infective matter of filth-disease to any person partaking of it, empirical standards notwithstanding.

No. 15 on the accompanying table is the analysis of a water from the chalk formation, and No. 16 of one from the marlstone rock bed of the Middle Lias. The analyses Nos. 8 to 14 represent well waters taken from a town, about two miles from the well I have described, situated on precisely the same geological formation, where the wells vary in depth from 7 or 8 to 20 or 25 feet, few being so deep as 20 feet. The nitric acid and other sewage accompaniments are unusually high, yet the free ammonia in all of them is low, and the albuminoid ammonia in all of them, except Nos. 14 and 16, would permit of their being placed in Mr. Wanklyn's second class, which, he says, are waters "safe organically." The two exceptions would come just within his third class, and would be styled "dirty waters."

But in all these instances the contamination of the waters had its origin at very short distances from the wells themselves, many of them having been specially examined because they were plainly the medium by which typhoid fever had been spread. To prove this assertion I give the distances of sources of pollution from the wells, as follows: No. 8, ash-pit and water-closet drain close; drain 10 feet. No. 9, open channel from urinal passes over the top of the

well; w.c. drain close; privy, 11 feet. No. 10, gully and drain, 3 feet; privies, 60 feet. No. 11, uneven surface channel drain close; privy vault, 31 feet. No. 12, grate and drain, 3 feet; w.c. drain, 15 feet; large midden and urinal, 47 feet. No. 13, scullery drain, 3 feet; uncovered ash-pit, 10 feet 6 inches; privy, 14 feet; w.c. drain, 24 feet. No. 14, gully and drain, 20 feet; enormous privy vault unemptied for 3 years, 25 feet. No. 15, well 90 feet deep in chalk; privy, 20 feet; cesspool, 45 feet; old cesspool, 30 feet. No. 16, slop holes, 6 feet; privy and leaking sewer near.

In the locality from which the series of waters Nos. 8 to 14 were taken, I have not often found any with very large quantities of free ammonia; and in many wells, under almost identically the same conditions with respect to the liability to pollution, I have many times found waters with high nitrates, but in which much less oxidation of the organic matter had taken place.

In newly-made wells situated in more recently inhabited parts, the oxidation is often less complete, the polluting organic matter being less changed into nitrates; but when the ground has been well saturated with sewage matters, and has become converted into a nitre bed, as it were, which property the variegated red marl of the Lias appears readily to assume, then the oxidation is carried much further. Yet surely it cannot with any reason be urged that water which has passed through this sewage-befouled soil is likely to be the less dangerous on that account, notwithstanding that much of the organic nitrogen may appear as nitric acid instead of in its original form.

In the series of analyses alluded to, the nitric nitrogen amounts on the average to 8·28 in 100,000, whilst the albuminoid ammonia nitrogen—which, by the way, does not represent the whole or even a constant proportion of the organic nitrogen left in the water—amounts to only ·0075 in 100,000. So 1,100 parts of the original organic nitrogen were oxidised and only one left, which shows that this residue is of a different and far more permanent character than the bulk; and in all probability this remainder of organic matter, however small it may be, representing as it does in all likelihood the organised and more resisting living part of the polluting matter, may be a most potent agent as a disease carrier. Therefore it matters not whether it appears in the analytical results as 0·1 or 0·0001, or any less quantity per 100,000; and it would appear more probable that greater danger lurks in this more stable organic matter than in the more readily oxidisable part.

Greater significance must therefore attach to minute quantities of organic matter when accompanied by any excess of the usual sewage accessories—chlorine, nitric, phosphoric, and sulphuric acids—over and above the normal standards belonging to the natural unpolluted water of the geological formation from which the sample under examination may have been taken, than when the substances mentioned are normal in amount. In other words it is safer to judge the quality of a water by the mineral constituents enumerated than by the organic indications, readily changeable as they are.

Some time ago I ascertained the weight of a dried *Daphnia pulex*, which I had taken out of a sample of water. I found it to be three-tenths of a milligramme, or not quite one two-hundredth of a grain. On distilling it with alkaline permanganate it yielded ·0000025 grammes of ammonia, which would have been represented in an ordinary water analysis as ·0005 albuminoid ammonia in 100,000 parts, because the quantity of ammonia it yielded would have been doubled, as only half a litre is usually taken for a distillation.

Each yeast-cell has but a weight of about one-ten millionth of a grain, yet these are the giants amongst the organisms with which we have to deal in reference to disease production.

But I shall err on the right side if I assume that a disease germ could weigh as much as a cell of the yeast plant. It would take 50,000 of these even to make up the weight of the *Daphnia*, and to yield the insignificant quantity of ·0005 part of albuminoid ammonia per 100,000. But if half a pint of water yielding that small quantity of albuminoid ammonia were drunk, about 2,200 yeast-cells might have been swallowed, and, in all likelihood, very many times that number of disease organisms, and we know not how few of them will suffice to convey disease, yet forsooth an empirical chemical standard, based upon the organic indication in the water, would declare it to be absolutely safe and free from danger!

I have known arsenic in quantities poisonous to beasts to traverse fifty yards into a well. Again, I have known carbolic acid to pass from a privy vault into a well fifty yards away, so as to make the water undrinkable; and I cannot doubt that these infinitely small bodies would be capable of being conveyed at least as far, and as they probably resist oxidation to a far greater extent than putrescible effete animal matter, being in fact the agents by which those sub-

stances are nitrified, much of the accompanying filth would be found in the water as nitric acid, whilst they themselves would furnish on analysis an amount of organic carbon and nitrogen, or of albuminoid ammonia, which, may be, would be represented in the third or fourth place of decimals, yet surely, since they are the morbid agents, the danger is none the less if those figures be small.

The infected dejections from even a single individual have been proved by Mr. Jacob and Dr. Thorne Thorne to have spread typhoid fever far and wide through the Caterham water supply. How much greater danger, therefore, must there be from the continual soakage of even very small quantities of sewage impurities into the limited and confined water in a house well.

Experiments made with the analysis of water containing portions of only solid excreta, do not correspond with the circumstances actually met with in practice, for there we have all the other constituents of sewage to help us in forming an opinion. If tricks have been played with a sample, surely analysis must not be blamed if correct results are not attained. But if we look at Dr. Dupré's analyses made for Dr. Cory's report on samples of water, purposely polluted with excrement, &c., contained in the Medical Officer's Report in the supplement of the eleventh annual report of the Local Government Board, it will at once be seen that the amount of phosphoric acid—the importance of observing which was, I think first insisted upon by Hehner—is a sure indicator of the presence of excretal matters, and is more uniformly reliable, as such, than the attempted estimation of organic matter; and I think that these results show that we should not presume to give any absolute opinion of the relative amounts of pollution in any water on the data obtained in trying to estimate the organic matter, and consequently that it is unscientific to attempt to classify waters on such determinations alone.

The fact is that such standards, simple as they have hitherto been, have been a mistake, a miserable makeshift, to bring us over a difficulty due to our ignorance. There are no unvarying standards in nature, least of all in the case of water; every brooklet, and the water from each geological formation having a composition peculiar to itself.

To judge a water with any approach to infallibility, we must first know all about its derivation, and then we no longer want a standard, whereas the empirical standards which have been proposed are just adapted to let us dispense with the specific

information respecting each sample. In fact, they would lead the unthinking or the uninitiated to believe that we are able to accomplish what is to us an impossibility. Our only standard, as insisted upon by Dr. Dupré and Mr. Hehner in a paper read before the Society of Public Analysts, must be the natural water of the locality and of the geological formation from which each sample is drawn; then the *slightest deviation* from this will be a sure indication of the degree of pollution any water may have undergone. Any fixed standard must be completely futile until nature shall be so obliging as to consent, in deference to its requirements, to acknowledge she has been wrong, and to renounce her usages of countless ages in its favour, so as to conform to what it says should be the case by making all her varied waters of exactly one and the same description. With very badly polluted waters it cannot be argued that there is any need for a standard; they simply exceed everything known in nature, they are natural impossibilities, artificial compounds produced by the filthiness or carelessness of man, and will at once be stamped as such by analysis, without the extraneous aid of an unnatural standard. Let us review the consequences of water standards which have been proposed. Have they not led to diametrically opposite opinions being passed on one and the same water by different chemists? So true is this that some of the medical inspectors of the Local Government Board have repeatedly told me that they have no faith in water analysis; in fact, one of them has said to me that for years past he has not had any waters analysed during the conduct of inquiries he has had occasion to make into the sanitary condition of, or causes of diseases in, any district.

What has Dr. Buchanan, the Medical Officer of the Local Government Board, to say on the subject? On page 9 of his report in the supplement to the tenth annual report of that board he writes in the following terms:—"Some very interesting examinations of the significance to be attached to the current methods of chemical analysis of potable waters have been made during the year. Samples of water were purposely polluted with one and another material, but especially with the stools of enteric fever patients, and were then submitted to examination by the chemist. Dr. Cory, to whom the inquiry has been entrusted, is not yet in a position to report on the whole results of it; but he has already learned enough to show that these examinations were greatly needed, in correction of judgments commonly pronounced about the whole-

someness and unwholesomeness of samples of water that have been the subject of analysis."

What is the result of adopting any empirical standard whatever? Does it not increase this discreditable muddle? I contend that it does in an extreme degree, and renders confusion worse confounded. I argue that any limited standard fails to do what it proposes. It tells us actually nothing about the presence or absence of pollution. In the face of the discrepancies due to the adoption of such standards, what marvel can there be that the utterances of water analysts are received with incredulity and distrust?

Then, again, if it were possible to devise any standard which would give reliable results in all cases—and I do not admit that it is—surely no constituent of the water could have a fixed value under all circumstances. For instance, it cannot be correct to give a certain amount of chlorine the same value when, say, the free and albuminoid ammonia and sulphates and phosphates, &c., are high, when it would almost for a certainty be derived from sewage, and be foreign to the water, as it has when these bodies are almost entirely absent, in which case its presence would very likely be owing to the water having been drawn from near a salt bed or the sea, and would be entirely natural to it, indicating no danger whatever.

And again, a given permanent hardness cannot have the same meaning in a selenitic water as in one which is naturally devoid of much permanent hardness, but in which it has been raised by sewage pollution. Neither can the high free ammonia of a deep Artesian well water, which ought to count for nothing at all, or the high albuminoid ammonia of a peaty water have the same significance, or point to the same danger, as similar amounts derived from the infiltration of the contents of a privy cesspit into a shallow well; and so on for all the other items of the analysis.

No item can possibly have one fixed value under all the varying circumstances which attach to water supply, albeit a fanciful standard handicaps all waters alike in respect of them. With water analysis it is not a question of quantity in sewage pollution. We cannot say that such or such a quantity of polluting material is dangerous, but that a half or a third of the same quantity is innocuous. The fact being that if a water exhibits the usual accompaniments of sewage, however small or large the indication of organic matter may be, it must be considered dangerous and unfit for use for dietetic purposes until we become acquainted with the natural conditions by which infective material can be rendered

inert and harmless. The method of determining organic matter, whether chemical or biological, whether by the combustion, distillation, or oxygen process, is a matter of little moment. They are all more or less qualitative tests, and tell very much the same tale. It is to the wretched wrangling, during the ten years past, over these rival processes, and to the ridiculously exaggerated importance that has attached to them, is due, in a large degree, the discredit into which water analysis has fallen amongst engineers and sanitarians. The facts which I have given in this paper should prevent any analyst from, as is often the case, fearlessly pronouncing a confident expression of opinion as to the perfect safety of a water, more than unlikely of unknown origin. If there is much indication of organic matter it often lends an additional reason for condemning a water, but the absence of it, *per se*, should not induce an analyst to report favourably on a sample. I am perfectly convinced that analysis of water, taken by itself, may furnish valuable *positive*, but not reliable *negative*, evidence as to pollution.

Analyses of Water referred to. Parts per 100,000.

No.	Chlorine.	Nitric Acid (N ₂ O ₅).	Sulphuric Acid (SO ₃).	Phosphoric Acid.	Total Solids.	Free Ammonia.	Albuminoid Ammonia.
1	7.0	5.0	5.2	v.h.t.	51.0	.0009	.0055
2	8.2	5.7	8.6	v.h.t.	56.0	.0323	.0282
3	6.6	19.4	6.8	v.h.t.	72.6	.0018	.0167
4	6.1	7.5	3.2	v.h.t.	52.4	.0016	.0079
5	5.9	17.6	10.8	v.h.t.	108.1	.0007	.0113
6	1.6	4.6	3.3	v.h.t.	31.9	.0013	.0188
7	3.0	5.5	3.5	v.h.t.	37.6	.0016	.0133
8	8.1	14.8	—	t.	93.6	.0024	.0098
9	19.0	43.9	—	h.t.	191.2	.0017	.0097
10	6.6	13.7	—	h.t.	94.2	.0025	.0058
11	11.2	22.5	—	h.t.	141.0	.0012	.0074
12	14.6	24.4	—	v.h.t.	161.5	.0024	.0098
13	12.6	27.2	—	v.h.t.	160.5	.0021	.0084
14	29.6	77.1	—	v.h.t.	275.7	.0019	.0137
15	5.2	11.6	—	h.t.	69.1	.0047	.0057
16	7.3	17.2	—	v.h.t.	90.2	.0014	.0103

t. = trace; h.t. = heavy traces; v.h.t. = very heavy traces.

Mr. Otto Hehner dwelt upon the uselessness of a single analysis of a sample of water as affording evidence of its wholesomeness.

Mr. Blyth stated that under the circumstances under which Dr. Ashby had worked, the estimation of a single element had some value, but that it was necessary for analysts to take into consideration every element, and that chemical analysis should always be supplemented by the use of the cultivation method.

Dr. Tripe was also of opinion that the cultivation method had much value.

"Outbreak of Small-Pox at the East End of London." By John W. Tripe, M.D., M.R.C.P., Ed., Medical Officer of Health for Hackney.

At the request of the President I now lay before you a brief account of this outbreak, which as far as Hackney was concerned is somewhat remarkable. During the latter half of last year there was an unusual persistence of Small-pox in the vicinity of the hospital as compared with the other parts of the district, although the disease was by no means confined to that locality. I attributed this in some measure to the drainage works that were then being carried out at the hospital, as a rather large number of workpeople were employed within the grounds, so that there was an unusual amount of communication between those engaged in the grounds and the inhabitants outside. There can be no doubt that the men engaged were at times brought into close contact with inmates of the hospital, as I saw them (the workmen) engaged at work in the recreation ground, and the patients taking an airing in the same place without any line of separation between them. I do not mean to say they were close together when I saw them, but they might have been at other times. Since the works have been finished the disease continued prevalent within half-a-mile of the hospital. The first decided notice of an impending epidemic was given by the occurrence of fifteen cases on February 22, of which four cases were treated at home and eleven were removed to the hospital. These cases occurred in nine houses, and no less than five were moved from one house on the 23rd, having been infected from a previous case in the same house. On March 2nd a case occurred

in the Upton House Reformatory School, in the person of a lad who had been in the house for two months. This school is just on the verge of the quarter-mile radius from the centre of the hospital, and as many as three cases have occurred on separate occasions in this school. One other isolated case occurred on March 14th in a female refuge, and a second in the person of a young woman who had left there to go to a situation several miles away on March 2nd. Neither of these persons had been outside the building for more than a month. I mention these to show not only the difficulty of ascertaining how the disease was contracted, but also that there was some probability of aerial infection. This refuge is in Dalston Lane, considerably more than half a mile from the hospital, and is situated in its own grounds at some distance from the road.

The spotted map which I produce shows the date and locality of the cases very well, as the different coloured spots indicate the days on which the cases occurred, black being used for the first day, *i.e.*, the 21st March, green for the second, red for the third and fourth, yellow for the fifth, and blue for the sixth day. They show that four cases, indicated by black dots (I use "cases" as signifying one case only in a house, and therefore four cases represent four houses), occurred within the quarter-mile radius, one within the half-mile, two within the mile, and only two outside. On the second day of the outbreak one occurred within the quarter-mile radius, five between the quarter and half-mile radii, two in the space between the half-mile and mile radii, and three outside. On the third and fourth days of the outbreak there were four in the quarter-mile radius, five in the space between the quarter and half-mile radii, seven in the space between the half-mile and mile radii, and five outside. On the fifth and sixth days, there were eight in the quarter-mile radius, four in the space between the quarter and half-mile radii, three between the half-mile and mile radii, and four outside; making a total of sixty-nine cases in sixty-five houses. The totals within the different spaces were as follows: twenty in the quarter-mile radius, fifteen in the space between the quarter-mile and half-mile radii, sixteen in the space between the half-mile and one mile radii, and fourteen outside. Roughly speaking, the population in the different spaces are 10,000, 30,000, 60,000, and 100,000, making up the total population of 200,000 persons. The ratio of cases (*i.e.*, infected houses) on this basis would be 2·00 cases per 1,000 population in the quarter-mile radius; 0·50 per 1,000 in the space between the quarter and half-mile radii; 0·27 per 1,000

in the space between the half-mile and one-mile radii; and only 0·14 per 1,000 in the remainder of the district. These figures, however, especially as regards the population outside the half-mile radius, are perhaps scarcely approximative, as I have not received notification of any case under treatment by private practitioners, nearly all the cases being those removed to the Asylum Board's hospitals, or which have become known to me through applications for disinfectants, or as the result of inquiries. As the majority of the persons living in the half-mile radius belong to a class which would send cases of Small-pox to the hospital, the ratios now given are most probably fairly approximative as regards those localities. The close grouping of the cases in the quarter-mile radius, as compared with those given in the half-mile radius, and especially in the other spaces, is very marked, and shows the much greater incidence of the disease in the vicinity of the hospital.

	WEEKS ENDING				
	March 6.	March 13.	March 20.	March 27.	April 3.
Hackney	5	4	4	66	15
Islington	6	2	4	14	—
Bethnal Green	3	1	2	15	—
Shoreditch	1	5	5	11	—
	15	12	15	106	15

I now propose referring to the number of cases in the month of March removed to the Asylum Board's hospitals from Hackney, Islington, Bethnal Green, and Shoreditch, and from all the other districts situated on the north of the Thames. It appears from information I have obtained that 168 cases of Small-pox were removed between March 1st and March 28th to the Asylums' Board's hospitals, out of which 142 were removed from the four parishes, viz., from Hackney 79, Islington 26, Shoreditch 22, and Bethnal Green 21, or 79 from Hackney against 69 from three other parishes. The population of Hackney in 1881 was 186,462, and of the other parishes 536,417, or about three times as many. There were 5 cases removed in the week ending March 6th from Hackney, and 4, 4, and 66 in the three succeeding weeks. In Islington the numbers for these four weeks were 6, 2, 4, and 14; for Bethnal

Green 3, 1, 2, and 15; and for Shoreditch 1, 5, 5, and 11 respectively, so that the number from all these places for each of the four weeks was 15, 12, 15, and 106. These figures show that a very decided outbreak took place in the week ending March 27th, and that its chief incidence fell upon Hackney. In the week ending April 3rd, there were only 15 cases, against 72 in the preceding week, removed from Hackney. There were also several other cases in Hackney which were treated at home.

That part of the district near the hospital, *i.e.* within the quarter-mile radius, suffered in greater proportion than even on later days. The chief incidence of the disease was to the west and south-west of the hospital, and also chiefly out of the line of traffic of the ambulances conveying the sick to the hospital. Besides this, the hospital contained fewer patients in March than in February, and very few patients during the week ending March 13, when the infection of those attacked during the outbreak must have occurred. Besides this, the five cases in Hackney which occurred during the week ending March 13 did not live near to the streets in which those attacked during the outbreak resided, with one exception, and that was in Ash Grove, which is more than a mile away from the hospital, and where the disease had been endemic for some weeks. If neither the route taken by the ambulances, nor the residences of the cases, which might have acted as a centre for the spread of the disease, can account for the outbreak, to what cause can we attribute it? Was it overcrowding of the hospital? No; for there were only twenty-eight cases on an average in it, during the week ending March 13, against above fifty in the early part of February. Was it the removal of convalescent patients from the hospital to the "Atlas"? To that I must again answer no; as the removal of those patients commenced on February 5, without any corresponding infection, as there was not any Hackney case taken to the hospital between February 15 and March 5, and also because the outbreak did not occur on the route taken by the ambulances. Was it caused by excessive moisture in the air, by the direction of the wind, by prevalence of calms, or any other known meteorological conditions of the atmosphere? These questions can probably be best answered by comparing the meteorology of the periods preceding the times of quiescence and prevalence of the disease.

During the weeks ending March 13 and 20, especially during the latter, the disease was comparatively little prevalent in Hackney, but was not entirely absent, as cases occurred on the 2nd, 3rd, 5th,

6th, 9th, 11th, 12th, 14th, and 18th of the month. On March 5, four cases occurred, but only one was near the site of the outbreak. On March 3 there were four cases, three of which occurred in streets which are situated within the quarter-mile radius, but in one only of these were there attacks during the period of March 20 to 25.

The general direction of the wind from January 20 to February 3 (which was a fortnight before February 3 to 16), during which only three cases came to my knowledge in Hackney, was W.S.W., *with an excess of speed*, so that it blew from the hospital which contained usually about fifty cases in the direction of a densely populated district, also up to February 14, when it changed to E.S.E. by N.E. and continued easterly up to the 19th, when the tendency was S.W. During the week ending March 1 it was variable, but frequently "easterly," being S.E. or N.E. on February 28, 29, March 1, 2, 3, and partly 4, but on the 4th it veered to S.W.; was S.E. at times on the 8th, 9th, and 10th; N.N.E. on the 11th, S.E. on part of 12th, and then S.W. on the 13th and 14th. As the disease prevailed chiefly to the S.S.W. and W. of the hospital, the wind was not in a quarter to have carried the infection where the disease occurred, unless it veered for a short time, without being noticed, to due E. or E.N.E. on the 8th, 9th, and 10th, which was the direction requisite to spread infection. If the wind spread it, why did it do so then, and not at the end of February and early in March, when it was decidedly favourable for its spread? In February the wind travelled, as a rule, more miles than usual in a day, but from February 26 to March 12 there was a deficiency in the number of miles with the exception of the 4th, 5th, and 10th, when there was a slight excess, the greatest deficiency being on the 6th and 7th, but on neither of these was there anything like a calm. I would mention here that I recorded the direction of the wind only at 9 a.m., so that I cannot say in what direction it blew at other times of the day. The degree of humidity of the air was below the average on February 29, March 1 and 2, much above it on the 3rd and 4th, much below it on the 5th, somewhat below it on the 6th, 7th, and 8th, much less than it was in the corresponding period of 1882, when the disease was not prevalent in Hackney.

The known meteorological conditions which prevailed during the time that the infection was spread in Hackney were not very different from those in the former part of the year, except that the wind was not so strong as it ordinarily is. There was also a total

absence of ozone at the end of February, a considerable quantity on the 2nd, 3rd, and 4th of March, and a deficit again up to the 9th.

The facts about this outbreak are few but clear, viz., the disease became prevalent in Hackney on the 20th, and in Islington, Bethnal Green, and Shoreditch on the 21st; but in Hackney alone was there any marked aggregation of cases in one locality, and that chiefly in the vicinity of the hospital, especially within the quarter-mile radius. This aggregation around corresponds very closely with a spot map of "Deaths from Small-pox in 1871-80." I think the line of cases, as shown on the map, indicates that it was spread from the hospital by the atmosphere, but the examination of the meteorology of the period does not afford the necessary proof of the mode in, or the cause by, which it was spread.

In conclusion, I would say that no personal communication between the infected persons was ascertained on a minute inquiry, whilst the red spots forming an almost direct line from the hospital in a south-westerly direction show that cases occurred in the City of London Union in the person of an inmate who had not been out of the Union for some time; of another in Churchill Road, where the disease has hitherto comparatively rarely occurred; in two houses on opposite sides of the Urswick Road; and another case on the following day after in Templar Road. If the line be continued for more than a mile, the coloured spots will be found a little on one side or other of the line, and but rarely elsewhere, and in no case was there any ascertained personal communication between these persons. The inquiry on this point was as careful as could be, nor, indeed, except as regards the two patients in the Urswick Road, who were servants, was there any reasonable chance of any such communication having occurred.

The closeness of the grouping of cases near the hospital, as compared with the proportion elsewhere, is, in my opinion, the strongest evidence in favour of the theory that the disease was spread in the neighbourhood of the hospital by infective matter borne to the affected persons through the atmosphere. The tendency of zymotic diseases to spread more at certain times than others was well known to the older writers on these diseases, and has also been often observed in the present century. Indeed, during the last fifteen years, I have noticed these sudden explosions, as they may be termed, of infectious diseases, especially small-pox, which, as far as I can ascertain, have arisen from some unusual but unknown condition of the atmosphere which tends to make

the infective matter occasionally more active than at ordinary periods.

The President pointed out that the prevalence of Small-pox round the Fulham Hospital did not follow the course of any prevailing wind.

Mr. Blyth thought that the eddies in different streets would not always take the same course as the prevailing wind.

"The Sanitary Supervision of Bakehouses, with Special Reference to those of Birmingham." By Alfred Hill, M.D., Medical Officer of Health of Birmingham.

In fixing upon a subject for a short paper to be read before this Society, the usual difficulty of deciding presented itself; the decision, in the present instance, was determined by the circumstance of the passing of the Factory and Workshops Amending Act of last year, which transferred the duty of the Sanitary Inspection of Bakehouses from the Inspectors under the Factory and Workshops Act, 1878, to Medical Officers of Health.

This change is really not the inauguration of a new system, but a reversion, after five years, to an old one which had previously been in operation for fifteen years; for by the Bakehouse Regulation Act, 1863, the duty of inspection of bakehouses devolved upon the local sanitary authority, and it was not until the repeal of this Act by the Factory and Workshop Act of 1878, that such duty was transferred to the inspectors under the Factory and Workshop Act of that year. Seeing that the duties involved refer principally to sanitary conditions, it must be admitted that the sanitary provisions of the amending Act of 1883 are made in the true interests of public health, for I cannot help thinking that under inspection by medical officers of health, such a state of the bakehouses as has been revealed in the Metropolis would have been impossible. It appears to me that there are two good reasons at least why lay should be less efficient than medical officers. The first is that a non-medical inspector would not sufficiently direct his attention to sanitary defects, being less acquainted with their character, and less interested in them; and the second is that his general duties would, from their extent, not allow him time to make the necessary examinations. But dismissing all speculation, it seems to be a fact that

inspection of late has not been either sufficiently thorough or sufficiently frequent. And although cases of sanitary defect might have been referred to the medical officer of health, my experience is that the factory inspector has very seldom availed himself of the clause empowering him to make such reference. Although, therefore, additional work is thrown upon the medical officer by the new arrangement, it is one which I think must meet with the approval of the whole body of medical officers of health.

As the change is one involving new duties and experiences, I imagined it would prove an interesting and fruitful field of action. The somewhat startling revelations that have been made respecting the condition of Metropolitan bakehouses led me to expect that a similar state of things would be found, to some extent at least, in Birmingham; but I am glad to learn that this is not so, and that the condition of our bakehouses is, on the whole, satisfactory as regards the existence of gross sanitary defects and abuses.

The bakehouses embraced by this paper are 198 in number, and were inspected between the passing of the amended Act and April 30th, or during a period of four months.

The inspection of the first seventy-seven bakehouses was made by myself, assisted by the inspector of nuisances; but I soon found that it would be utterly impossible for me to find time to perform the work personally, and it became a necessity to depute it to an inspector specially appointed for the purpose, on the principle "qui facit per alium facit per se." On representing to the health committee the state of the case, an officer was appointed to devote himself exclusively to the inspection of bakehouses and milk-shops; the number of the former in Birmingham I have not yet been able to ascertain, but it amounts to some hundreds, while the milk-shops number over 2,000. The inspector has been specially instructed in the mode of measurement and inspection, and he submits to me his books three times a week, when I examine his notes and records, and confer with him on such points as require discussion or special action.

The points to which I have directed attention are principally position, cubic space, cleanliness, drainage, ventilation, accumulations of refuse, frequency of lime-washing, keeping of animals, employment of women, young persons or children, provision for sleeping, existence of water-closets, &c., in or adjoining bakehouses, and water supply.

With regard to position most of the bakehouses are on the ground

level, only very few old ones being underground or consisting of cellars converted, and more or less well lighted. The cases in which the light was very deficient were very few indeed. Some of the bakehouses on the ground level consist of back kitchens and wash-houses diverted from their original use, in some cases being small and inconvenient, in others, however, fairly well adapted for their new purpose. The majority of modern bakehouses are detached buildings, capacious, well ventilated, and admirably well suited to the requirements of convenience and health.

The cubic space was found to vary within pretty wide limits, the lowest amount, with one peculiar exception, being found to be 190 cubic feet, the highest 5,300, and the average 827 cubic feet per head. In no instance could there be considered overcrowding. Cleanliness is well observed as a rule, both as regards the condition of the walls and surfaces, and the state of the utensils. Out of the 198 places examined only 21 were found not to have been lime-washed with the regularity and frequency required by the Act, and in the best conducted establishments it is common to find that lime-washing is done every three months. From the difficulty of ascertaining the frequency with which the painting of woodwork is done, cleansing of this kind is pretty sure to be neglected, and my impression is that it is done with much less frequency than is either required or is desirable.

The drainage, as a rule, is well arranged, sinks being disconnected from the drains, and there being very few drain traps situated on the floors. The total number of drainage defects was 12, and these existed more from the want of better knowledge than from any desire to evade sanitary requirements. In every such instance the defect has been remedied on a request and pointing out the danger of its continuance.

Defective ventilation was found in 20 instances, but, as a rule, there was no ground of complaint on this head ; it is not that there were no means of ventilation, but that the workmen objecting to draughts intentionally closed the various openings. They become very warm in their work, and, at the same time, more sensitive to cold air, so that it is hardly to be wondered at that they are afraid of draughts.

Accumulations of refuse, principally vegetable, were found in only four instances, but in one of these cases the accumulation consisted of sawdust and fine ashes from the furnace spread upon the floor and allowed to collect to the depth of more than two inches.

The keeping of animals in bakehouses does not prevail to any considerable extent, though the fondness for such domestic pets and the keeping of them in improper places is rather common in the town. Dogs were the only animals discovered in the bakehouses, and these in only three instances. In connection with this point I may state that in only one case did I find a marked odour from the presence of mice.

The employment of children, young persons, and women obtained in fifty of the bakehouses, the numbers of each class being 1 child aged 13, 36 young persons, and 21 women, making a total of 58 of such persons. In all cases of the employment of the classes just named I report to the factory inspector, who is glad to have such information conveyed to him; the information which the factory inspector and the medical officer of health can mutually furnish each other is necessarily calculated to prove very beneficial, and I am pleased to say that in Birmingham, as I trust everywhere else, there is the best of feeling between them.

Water-closets, and other similar forms of convenience, were conspicuous by their absence; in no case did I find one in the bakehouse or in close contiguity to it, but in one case a stable was found in direct communication with the bakehouse, which was pervaded by its characteristic odour, and the same remark as to absence applies to sleeping accommodation. In Birmingham we are well provided with cheap and convenient lodgings in all parts of the town, so that there is really no necessity for such undesirable arrangements.

The conclusions to be drawn from the facts considered are very favourable; many of the points to which attention has been directed are of a negative rather than a positive kind, and it is satisfactory to find that in no case where cause for complaint has been found has it been necessary to do more than make a request for its removal, or, at most, to serve an official notice in order to obtain compliance, no magisterial proceedings having been yet found necessary.

Very little hesitation has been manifested to allow the first inspections to be made, but more frequently such inspections are hailed with satisfaction; they are regarded by intelligent and respectable persons not only as generally desirable, but as a means of conferring benefit on both the master and his employés.

At the rate at which inspections are now being made it will take our inspector about one year to complete the round of the bake-

houses ; probably such an annual inspection made regularly and efficiently may be enough ; this, however, is a point to be settled only by experience, and should more frequent inspections be necessary their number can be readily increased. It is evident, however, that the requirements in this respect will differ in different towns.

Dr. Dudfield referred to the advantages conferred by the last Act, but said there was still much need for the registration of bakehouses and for their regulation under bye-laws. Those in Kensington were in good condition, but he attributed this to the fact that inspection had not been abandoned during the time bakehouses were under the control of the factories inspector.

Dr. Bate had included in his visits places where meat pies were prepared, and had found them in a very dirty condition ; his authority had, on his advice, determined to prosecute the occupiers, and one case would be heard shortly.

Mr. Shirley Murphy was finding no difficulty in abolishing water-closets situated in bakehouses ; he believed much good would come of the Act, but was of opinion that registration and regulation under bye-laws would alone ensure bakehouses being kept as they should be.

Mr. Corner commented on the need for excluding employés while suffering from ill-health : he had not infrequently found them suffering from venereal disease while engaged at work. He asked if the health officers of Birmingham acted under any municipal law to compel notification of infectious diseases.

Dr. Simpson said that bakehouses in Aberdeen were in a very unsatisfactory condition, water-closets were often situated within them, and not being provided with a door, the bakehouse was practically converted into a water-closet. He doubted if the duty of inspecting bakehouses could be deputed by the medical officer of health to anyone else ; he had failed to get meat-pie bakehouses recognised as bakehouses.

Mr. Lovett found employés in bakehouses to be clean in their habits ; he had no difficulty with any but foreigners ; Italians were especially filthy in their habits.

Dr. Alfred Carpenter thought there was need for notification of existence of infectious diseases in bakehouses as well as in milk shops.

Dr. Hill, in reply, stated that in Birmingham no distinction was made between meat-pie and bread bakehouses ; there was no compulsory notification, but every medical man received five shillings

for giving notice. The sick were removed to hospital or the shop closed ; there was no special power to close a shop, but this was accomplished by placing a man opposite the shop to tell every one about to enter that there was a case of infectious disease in the house. Removal to hospital was usually consented to.

"On the Calculating Slide Rule as an Assistant to the Medical Officer of Health in Mensuration and Statistics." By George Paddock Bate, M.D., Medical Officer of Health for St. Matthew, Bethnal Green.

Slide rules are instruments of immense use for purposes of calculation ; they are easily learned, and are not liable to get out of order. To one who has once worked with the slide rule, and acquired facility in its use, it is always a matter of astonishment that an instrument so rapid and accurate in its results should be so little known, as the drudgery of calculation is saved, and the trouble and liability to error involved in figuring out long sums is avoided by the help of this instrument.

Slide rules are of various patterns, and I show upon the table specimens of several different kinds. All are constructed upon the same principle, though varying in detail and in manner of usage. The slide rule in its simplest form is a logarithmic scale of double radius ; each half reads from one to ten, and each division is subdivided into tenths and hundredths ; a precisely similar scale slides in a groove below it, and the divisions of the sliding scale read against those of the rule itself. The fundamental principles of logarithmical arithmetic are that the multiplication of common numbers is performed by the addition of their logarithms, division by their subtraction, and involution and evolution by the multiplication and division of the logarithm by the index of the power or root required. The slide rule is merely a contrivance for facilitating this, and for avoiding the trouble of hunting out the logarithms of numbers from printed tables, and of turning the resulting logarithms back again into simple numbers. Ordinary addition and subtraction cannot be performed by the slide rule, as it simply multiplies and divides.

The ordinary slide rule is a very portable instrument, but its scale is so short and the divisions are so minute that considerable practice is required before it can be used so as to obtain accurate results. Moreover, it is very trying to the eyesight, for in each operation the *first* figure only is read, and the others have to be found by counting up so many tenths, hundredths and thousandths.

The rule to which I wish to draw special attention this evening is the one which is the invention of Professor Fuller, of Belfast. In this the scale, instead of being straight, is wound in a spiral form upon a cylinder, and the reading is performed by indices instead of by slide against slide, which is an immense advantage. This spiral slide rule is equivalent to a straight slide rule 83 feet 4 inches in length. The divisions are much more open than in the short rule, and the results are more easily and accurately read.

In each operation the first *three* figures will be found engraved upon the rule ; the fourth is counted up by the number of tenths, and the fifth has to be estimated by the eye as quarter, half, or three-quarters of a tenth ; the results are then absolutely correct up to the fourth figure, while the fifth and sixth are only approximately so, but with practice great accuracy may be obtained.

All numbers and divisions are to be read decimally, so that, owing to our want of a decimal system, all measurements and quantities must be converted into decimals before they can be worked on the rule. In order to simplify this process as much as possible, a series of tables are engraved upon the body of the rule, giving the value in decimals of fractions of the various measurements of length and capacity, and also of money and time, together with some other very useful tables of values.

The rule consists of a cylinder (upon which is engraved the scale) ; this can be moved up and down upon and turned round a body or axis, which is held by a handle ; fixed to the handle is an index, called the “fixed index” ; two other indices (whose distance apart is the axial length of the complete spiral) are fixed to a telescopic tube which slides in and out of the body ; these indices can thus be placed in any required position with regard to the cylinder, or to one another.

The rule will work with the greatest ease and certainty multiplications and divisions containing a series of factors, single and double proportion, ratio and interest ; and by means of the upper scale, which it would be somewhat confusing to describe without the rule in hand, the powers and roots of numbers are within the capacity of the instrument.

It will be seen that the scale commences with 100 and ends with 999 ; the hundred is read either as one, or ten, or a hundred, or a thousand, as may be required ; all the others follow in like manner, so that 999 may be either .999, or 9.99, or 99.9, or the whole number ; thus it is always necessary to know the value of a result for which there are certain simple rules laid down.

MULTIPLICATION; A \times B.—The cylinder is moved till the first factor is read at the scratch on the fixed index, the movable index is set to zero, the second factor is then brought to the same index by moving the cylinder, and the product is read at the fixed index, and so on with any number of factors, such as the height, length, and breadth of a room.

The rule for the number of figures in the product is the algebraic sum of the number of figures in the factors, minus one for each factor brought to the upper movable index.

DIVISION.—State the divisor and dividend as a fraction, thus—

$$\frac{600}{300} = x$$

Set the fixed index to the numerator and the movable index to the denominator, then move the cylinder till the upper movable index is at zero, and the quotient will be found at the fixed index; the rule for the number of figures is the algebraic difference between the number of figures in the divisor and the dividend, plus one for each time the upper movable index is set to the denominator.

MORTALITY RATES AND PERCENTAGES.—The ordinary method is to multiply the number of deaths by one thousand or one hundred, and divide by the population. I have here the President's report on the Vital Statistics of Kensington for the year 1881. Table I. gives the necessary data for calculating the rates, shown in Table II. In order to show the degree of accuracy with which the rule works, I give in each instance the actual result as calculated by ordinary arithmetic to three places of decimals.

$$1880. \quad \frac{2884 \times 1000}{161462} = 17.862 \text{ per thousand.}$$

The true result is 17.861 , ,

$$1879. \quad \frac{2992 \times 1000}{158316} = 18.898 , ,$$

Should be 18.896 , ,

$$1878. \quad \frac{3120 \times 1000}{154305} = 20.220 , ,$$

Should be 20.219 , ,

$$1877. \quad \frac{2625 \times 1000}{151310} = 17.349 , ,$$

Should be 17.348 , ,

$$1876. \quad \frac{2896 \times 1000}{148338} = 19.521 , ,$$

Should be 19.522 , ,

ESTIMATING POPULATION is best done by logarithms for rapidly growing districts, and the estimate may be checked in the ordinary way by the birth-rate and by the number of inhabited houses ; but by the slide rule it is very easy to estimate the number of persons existing at any particular age, upon the assumption that the ratio existing at the census enumeration remains undisturbed. For when either of the movable indices is at one number, and the fixed index is at the other, and the cylinder is turned into any other position, though the numbers at the indices will be different, *their ratio will remain constant*. Thus, if one index be set to the Bethnal Green population, as enumerated in 1874 (120,104 persons), and the other to the number of children under five years of age (18,142), and the cylinder be now moved round, so as to bring the estimated population for each year to the upper index, the proportionate number of children may be read off at the fixed index year by year, until we arrive at the 1881 population as enumerated (126,961 persons), of whom 19,380 were children. Now reading the rule we find it gives at the fixed index 19,180, two hundred short of the true number ; this is not the fault of the rule but of the method, the results of which can only be an approximation, and when we distribute the error over the ten years, it is very small, only 20 per annum.

MENSURATION.—The cubic capacity of rooms having a rectangular form is calculated by the multiplication of the height, length, and breadth, and for this purpose it is easier to take all measurements by the decimal measuring rod. I have had constructed and use measuring rods divided into feet and tenths of feet instead of inches : but this is not absolutely necessary, as the printed table on the body of the rule gives the decimal value of fractions of a foot.

CIRCULARWARDS.—Several hospitals have been built lately with circular wards. The calculation of the cubic contents of such as these would be somewhat tedious, as the method given in books on mensuration is $3\frac{1}{7}$ times the square of the radius multiplied by the height. The decimal value of $3\frac{1}{7}$ is 3.1416, and a ward 52 feet in diameter by 16 feet in height would work out as follows :—

$$26 \times 26 \times 3.1416 \times 16 = 33,979$$
 cubic feet. Calculated out in the ordinary way, this gives a decimal fraction over ; but unless the original measurements are taken with extreme accuracy, it is a superfluous refinement to carry the result to a fraction, so that the figures as given by the rule are quite sufficient.

With a little practice one finds the rule capable of working out many problems, and I should not now like to be without mine.

Indeed, I often wonder how I got on before I heard of it, as I am a bad calculator.

It is almost needless to say that all problems must be correctly stated before they can be worked on the rule, for, though wonderfully accurate, it is only a machine, and of no more use to a person who cannot correctly state a rule-of-three sum than a pencil is to a child.

The manufacturer of the instrument is Mr. Stanley, of Great Turnstile, and his name is a sufficient guarantee for the accuracy with which it is made. To the kindness of Mr. Stanley I am indebted for the loan of the other slide rules I show upon the table.

OFFENSIVE BUSINESSES.—The president called attention to the appeal case, “*Passy (appellant) v. Oxford Local Board respondents*,” in which the late Lord Chief Justice Cockburn and Mr. Justice Lopes had upheld the decision of the magistrates at a petty sessions at Oxford, that the business of the appellant—a bone and rag merchant—carried on by him at Oxford, was, as a matter of fact, a noxious and offensive one; and, as a matter of law, was of the same character as the six trades specified in sect. 112 of the Public Health Act, 1875. He argued, therefore, that the said business was of the same character as the trades enumerated in sect. 3 of the Slaughter Houses (Metropolis) Act, 1874; and gave reasons for the opinion that the business of a rag and bone merchant should be scheduled and regulated under that section, and come under bye-laws as the only effectual way of preventing recurring nuisances. He added that the local authority (Metropolitan Board of Works) had declined to schedule the business on the application of the Kensington vestry, on the ground that “the businesses to which the Act of 1874 refers are businesses which include processes of manufacture of a more or less offensive character, and that it did not appear to the Board that the mere collection of a mass of refuse matter into one place was a ‘business’ within the meaning of sect. 3 of the Act.” But in the Oxford appeal case the judges had arrived at a different conclusion, deciding that a “business in order that it may be brought within sect. 112” of the Public Health Act, 1875, “should be *ejusdem generis* with those specified in that section” (which is practically identical as to the businesses therein mentioned with sect. 3 of the Slaughter-houses Act). Those “businesses,” the Lord Chief Justice said, “seem to include animal matter in some form; and here there was animal matter, with the bones

stored on the premises, and the mere exposure of bones with animal matter may be very offensive." The President remarked that in addition to "bones" and other forms of animal matter, at many of these shops large quantities of fat, often in a foul and offensive condition, were collected prior to removal to the fat melters, where the regulations require it to be so stored as not to be a nuisance by escape of offensive effluvia into the open air; and he urged that if the business of a bone and rag merchant were regulated by bye-laws, all offensive matters would have to be so stored as that they could not become a cause of nuisance. Moreover, if nuisance did arise, it would only be necessary to prove breach of the bye-law, and the offender would be fined, whereas, under the Nuisances Removal Acts, needless difficulties arose, and it was found practically impossible to prevent the frequent recurrence of cause of complaint.

Mr. Spencer stated that in deciding not to declare the business of a marine store dealer an offensive business under the third section of the Slaughter-houses, &c., (Metropolis) Act, 1874, the Metropolitan Board of Works had probably been mainly influenced by the fact that the nuisance complained of arose from accumulations of offensive material, and not from the carrying on of any trade process. The businesses named in the Act, including those of bone boiler and tallow melter, mentioned by Dr. Dudfield, involved the carrying on of trade processes producing offensive effluvium, and the object of the Act was to secure that those processes should be carried on without nuisance. The trades which had already been declared offensive under the section, such as the manufacture of glue and size, the drying of blood, the scraping and manufacture of gut, &c., all include one or more processes causing nuisance of manufacture. The nuisance complained of in connection with marine store shops arose from the collection of stale fat and bones, and the decision in the case *Passy v. the Oxford Local Board*, referred to by Dr. Dudfield, while settling the point that the business was *ejusdem generis* with the businesses named in the Public Health Act, did not in any way touch the question whether or not it was desirable to declare it an offensive business in order to deal with it by bye-law. There were serious practical difficulties in such a course; such, for instance, as the definition of what constituted a business, for probably there was hardly a household in which fat and bones were not collected to some extent. The Nuisances Removal Act appeared to give ample power for dealing with nuisances of this character, when judiciously and persistently enforced;

but if medical officers generally agreed that the power given by the Nuisances Removal Acts was insufficient, and if a strong case could be made out for dealing with the business in the way suggested by Dr. Dudfield, it might be well to ask the Metropolitan Board of Works to reconsider the matter, but it would probably be useless to again raise the question unless there was general agreement backed by strong evidence.

Dr. Dixon pointed out that some difficulty would necessarily attend a decision as to the number of bones which would come to constitute a trade. There were a large number of shops receiving very small quantities of bones from private houses. He thought the subject best dealt with under the Nuisances Removal Act.

Dr. James Stevenson said that the delay in the collection of the bones was the main difficulty, and that if the more speedy removal could be enforced there would be less opportunity for nuisance to arise.

SECRETARIES' ANNUAL REPORT, 1883-84.

The Society held twenty-three meetings during the year which ended 30th June, 1884. These include the eight ordinary meetings of the session, when papers in connection with public health were read and discussed, fourteen meetings of the Council, and the annual meeting held at the end of the session for the election of officers for the year ensuing, and for the general business of the Society.

All the meetings, with the exception of the annual meeting, were held at 1, Adam Street, Adelphi.

The changes that have taken place in the list of members during the year have been somewhat numerous. Amongst these may be noticed the death of Dr. Barclay, of Chelsea, and Mr. Pink, of Greenwich, two Metropolitan members, and Dr. Angus Smith, and Mr. J. Netten Radcliffe, Associates. Mr. Liddle, one of the oldest members of the Society, Dr. Browning, of Rotherhithe, and Dr. Rygate, of St. George-in-the-East, resigned their membership in consequence of having retired from their respective offices. Mr. Crosse, of Norwich, and Mr. Freeland, of Chichester, extra Metropolitan members; Dr. Brookfield and Dr. Baylis, retired Medical Officers of Health; and Dr. Morgan, Dr. Francis, Dr. D'Arcy Adams, Dr. P. Burgess, and Mr. H. P. Potter, Associates, have all resigned their membership. On Mr. Pink retiring from his office, which he did some time before his death, the District of Greenwich was divided into two divisions, the Greenwich, and the Deptford divisions, to which Mr. C. H. Hartt and Mr. H. W. Roberts have been respectively appointed. These gentlemen have both become members of the Society.

The following members were elected during the year:—

METROPOLITAN MEMBERS.

- Mr. R. Bianchi, St. Saviour's.
- Dr. C. Evans, Strand.
- Dr. W. T. Iliff, Newington.
- Mr. H. W. Roberts, Deptford.
- Mr. C. H. Hartt, Greenwich.

EXTRA METROPOLITAN MEMBERS.

Dr. B. Anningson, Cambridge.
 Mr. C. E. Paget, Westmorland.
 Mr. S. M. W. Wilson, King's Lynn.
 Dr. C. S. Kilner, Thingoe, Suffolk.
 Mr. H. Osborn, Southampton.

RETIRED MEDICAL OFFICER OF HEALTH.

Dr. W. G. Walford, 49, Finchley New Road.

ASSOCIATED MEMBER.

Mr. H. P. Potter, Infirmary, Kensington.

The list of members includes 111 metropolitan and extra metropolitan medical officers of health, 12 retired medical officers of health, 34 associates, and 18 honorary members; together 175 members.

Dr. J. W. Tripe having presided over the Society for the customary period of two years, retired from that position, and was succeeded by Dr. T. O. Dudfield, as President.

At the commencement of the session an inaugural address was delivered by the President; entitled "The need of Unity in Metropolitan Sanitary Administration," in which he dwelt on the benefits calculated to arise from a uniform action on the part of Sanitary Authorities, and the advantages that would result if these bodies and their officers had efficient bye-laws for their guidance in the performance of their duties.

A Paper was read by Mr. E. Nicholson, Brigade Surgeon, Army Medical Department (retired), on "The Water Supply of Troops in India," in which he described the sources of water supply to the troops, its storage and purification, and traced the connection between the character of the water and disease, especially diarrhoea and typhoid fever. This paper was followed by a discussion which was joined in by several gentlemen having considerable Indian experience.

"The Artisans Dwellings Acts, with Suggestions for their Improvement," was the title of a paper by Dr. Tripe.

Mr. Wynter Blyth read a paper in which he gave an account of the work done by the Vestry of St. Marylebone, under the Artisans and Labourers Dwellings Acts, 1879 and 1882.

A considerable discussion followed the reading of these papers, in which it was urged that Torrens's Acts were almost useless, owing to the expense and delay necessary to enforce their provisions. The destructive habits of many people living in tenement dwellings, and the difficulties experienced in effecting their removal, were dwelt on. It was also suggested that much good would result if regulations made under the 35th section of the Sanitary Act were carefully and steadily enforced.

The results of a nine years' stewardship as Medical Officer of Health at King's Lynn formed the subject of a paper by Dr. W. G. Walford. The difficulties he had to contend with were described, and the results which were obtained, especially with regard to the improvement of the dwellings of the poor.

An elaborate paper was contributed by Mr. Cassal and Dr. Whitelegge on Water Analysis, which was followed by a lengthened discussion.

Notes on some cases of Poisoning by Copper formed the subject of a paper by Mr. Fosbroke.

The subject of the Manufacture of White Lead, and its effects on Health, was introduced by Mr. F. M. Corner.

The Fallacies of Empirical Standards in Water Analysis were pointed out by Dr. Ashby, in the "Story of a Polluted Well."

An extensive outbreak of Small-Pox having occurred, chiefly in the Hackney district, a paper on the subject was contributed by Dr. Tripe, in which he traced the origin and progress of the disease.

Dr. Hill read a paper on the Supervision of Bakehouses, in which he made special reference to those of Birmingham.

An interesting paper on the Calculating Slide Rule as an assistant in Mensuration and Statistics, was contributed by Dr. G. P. Bate.

NEW TEST FOR THE PRESENCE OF LEAD.

Mr. Wynter Blyth demonstrated a new test for the presence of lead in drinking water. A few drops of an alcoholic tincture of cochineal added to water containing a trace of lead strikes a blue

instead of a red colour. One part of lead in 70,000 parts of water gives a very distinct re-action. By this means one part of lead in 2,000,000 parts of water may be detected. All soluble salts of lead give the same re-action. Copper gives a somewhat similar colour, but not identical. The water must be neutral or alkaline for the test to succeed.

BAKEHOUSES.

In the Secretaries' last Report mention was made of the unsatisfactory state of legislation with regard to Bakehouses since the supervision of them was removed from the local authorities and placed under that of inspectors under the Factory and Workshop Act. A memorial from the Society was presented to the Home Secretary, pressing upon him the desirability of restoring to the local authorities the powers possessed by them under the Bakehouse Regulation Act. An Act has since been passed, entitled *Factory and Workshop Act, 1883*, the effect of which is that the sanitary regulation of bakehouses has now been retransferred to the Sanitary Authority in every Urban and Rural Sanitary District, and more stringent regulations can be enforced with respect to bakehouses let or occupied after the 1st of June, 1883. The sections of the Act of 1878, which the Sanitary Authority has power to enforce, are 3, 33, 34, and 35, which relate to cleanliness, ventilation, freedom from overcrowding, and other sanitary conditions.

On consideration of the duties devolving on Medical Officers of Health, under the Factory and Workshop Acts, 1878 and 1883, a series of "Suggestions for Regulations with respect to Bakehouses" was framed by the Society for the guidance of its members and of local authorities.

REGULATIONS FOR HOUSES LET IN LODGINGS.

The Local Government Board, having by notice published in the *London Gazette*, declared the 35th section of the Sanitary Act, 1866, and the 47th section of the Sanitary Law Amendment Act, 1874, to be in force in the whole of the Metropolis, and having prepared "Suggestions for Regulations with respect to Houses let in Lodgings," the Society considered the said suggestions, together with the "Standard Regulations" prepared by the Society in 1879, and finally adopted a modified code of suggested

regulations which was recommended for use in the Metropolis. The "Suggestions" were made to be as little vexatious as possible, consistent with efficiency, and in the hope of proving useful for the guidance of Metropolitan Local Authorities and Medical Officers of Health.

CHOLERA.

A circular letter was addressed on December 19th, 1883, to Metropolitan Medical Officers of Health by the Clerk to the Metropolitan Asylums Board, and enclosing a Memorandum on a Conference held at the Local Government Board on November 1st, 1883, at which the provision of Hospital accommodation for cases of cholera was considered, and various suggestions made, upon which the opinions of the several Medical Officers of Health were invited. It was observed with satisfaction that a large amount of accommodation will be available if required, and that the various suggestions of the Conference are calculated to prove effectual for dealing with a possible outbreak of the disease.

PUBLIC HEALTH (DAIRIES) BILL, 1883.

By the provisions of this Bill the Metropolitan Board of Works was re-constituted the Local Authority to the exclusion of Vestries and District Boards. The Society, therefore, addressed a memorial to the Local Government Board and the Privy Council, urging the desirability of making the Vestries and District Boards—each of which has a Medical Officer of Health and a Sanitary staff—the Local Authorities under the Bill, leaving the power and duty of framing uniform bye-laws for the whole metropolis in the hands of the Metropolitan Board of Works.

The Bill was ultimately withdrawn at the end of the Session.

THE LONDON GOVERNMENT BILL.

The following resolution was agreed to in reference to this Bill:—

"That the Society, without expressing an opinion upon the Bill as a whole, notes with satisfaction that its provisions appear well calculated to promote much-needed unity in sanitary administration."

VACCINATION AND RE-VACCINATION.

It was stated by some members that they had recommended their respective Vestries to adopt the plan of arranging with the Public Vaccinator to visit every house in which small-pox occurred, with a view to vaccinating or re-vaccinating all the inmates. There appears, however, to be no legal provision for the vaccination of persons under such circumstances, or for payment for the performance of the operation, unless by the Poor Law Medical Officer, in his official capacity, on the occurrence of small-pox in the house.

INTERNATIONAL HEALTH EXHIBITION CONFERENCE.

A communication was received by the President from the Duke of Buckingham, Chairman of the General Committee of the International Health Exhibition, inviting the Society to hold a Conference on "some question connected with Domestic Sanitation in Rural Districts." The proposal having been accepted, the Council was authorised to make the necessary arrangements. After these had been completed a further communication was received from the Executive Council of the Exhibition, suggesting the desirability of the Conference being managed conjointly by the Society of Medical Officers of Health, the Sanitary Institute of Great Britain, and the Parkes Museum of Hygiene. This suggestion was adopted, and a joint Committee of the three Societies was appointed to carry out the details, composed as follows:—

T. Orme Dudfield, M.D., <i>Chairman.</i> J. Syer Bristowe, M.D., F.R.S. A. Wynter Blyth, M.R.C.S.	<i>Representing the Society of Medical Officers of Health.</i>
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Alfred Carpenter, M.D., J.P. W. H. Corfield, M.A., M.D. Ernest Turner, F.R.I.B.A.	<i>Representing the Sanitary Institute of Great Britain.</i>
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Douglas Galton, Capt. R.E., C.B.,
F.R.S.
Rogers Field, B.A., M. Inst. C.E.
Louis Parkes, M.D., *Secretary.* } *Representing the
Parkes Museum of
Hygiene.*

The joint Committee held several meetings, and it was decided to extend the scheme approved by the Society; the following subjects for papers, with the authors, and the Chairmen of the several meetings of the Conference, being finally agreed to:—

Monday, June 9.—“The Domestic Sanitary Arrangements of the Metropolitan Poor.” By John W. Tripe, M.D., Medical Officer of Health for Hackney. “The Improvement of the Sanitary Arrangements of Metropolitan Houses.” By Ernest Turner, F.R.I.B.A.; *Chairman*, T. Orme Dudfield, M.D., President of the Society of Medical Officers of Health, Medical Officer of Health for Kensington.

Tuesday, June 10.—“Domestic Sanitation in Rural Districts.” By George Wilson, M.A., M.D., Medical Officer of Health for the Mid-Warwick District. “Sanitary Houses for the Working Classes in Urban Districts.” By Percy Boulnois, M.I.C.E., Borough Engineer, Portsmouth; *Chairman*, Capt. Douglas Galton, R.E., C.B., F.R.S., Chairman of Council, Parkes Museum of Hygiene.”

Wednesday, June 11.—“Industrial Diseases.” By John Syer Bristowe, M.D., F.R.S., Medical Officer of Health for Camberwell; *Chairman*, Edwin Chadwick, Esq., C.B., Vice-President of the Sanitary Institute of Great Britain (in the unavoidable absence, through illness, of His Grace the Duke of Northumberland, D.C.L., President of the Institute).

Thursday, June 12.—“How Infectious Diseases are Spread.” By W. H. Corfield, M.A., M.D., Medical Officer of Health for St. George’s, Hanover Square. “Cows’ Milk as a vehicle of Infectious and Epidemic Disease to the community, with suggestions for the more effectual prevention of such outbreaks.” By W. N. Thursfield, M.D., Medical Officer of Health, Shropshire Combined District; *Chairman*, Alfred Carpenter, M.D., J.P., Chairman of Council, Sanitary Institute of Great Britain.

Friday, June 13th.—“The right of the State to enforce Notification of Infectious Diseases, and the best method of doing it.” By Alfred Carpenter, M.D., J.P. “The Notification of Infectious Diseases: its importance and its difficulties.” By Alfred Hill, M.D., Medical Officer of Health for Birmingham; *Chairman*, The Right Hon. Earl Fortescue, Vice-President of the Parkes Museum of Hygiene.

Saturday, June 14th.—“The Disposal of the Dead.” By A. Wynter Blyth, M.R.C.S., Medical Officer of Health for St. Marylebone. “Cremation.” By W. Eassie, C.E.; *Chairman*, Sir James McGarel Hogg, Bart., M.P., K.C.B., Chairman of the Metropolitan Board of Works.

The Conference was a complete success. The papers were uniformly good and practical, and the discussion on them was sustained with spirit and unflagging interest. The attendance was large and representative, and the results of the proceedings have been collected in a volume of Transactions, ably edited by Dr. Louis Parkes.

Much of the success of the Conference was due to the admirable arrangements made on behalf of the Executive Council by Mr. Trendell, the Literary Superintendent of the Exhibition. Mr. Trendell's courtesy and attention were acknowledged in a letter of thanks addressed by the joint Committee to the Executive Council.

The papers read by the delegates of the Society will be found in the Appendix to this Report.

It is the custom of the Society to hold its annual meeting in July, but in anticipation of the presence in town of many country members, it appeared to the Council advisable to arrange for the meeting to take place at the Exhibition during the progress of the Conference. The meeting was accordingly held on 11th June, and was followed by a banquet, at which more than one hundred members and friends, including ladies, were present.

J. NORTHCOTE VINEN, M.D.,	}	<i>Hon. Secs.</i>
SHIRLEY F. MURPHY,		

June, 1884.

FINANCIAL STATEMENT OF THE SOCIETY.

Receipts and Expenditure from July 1st, 1883, to June 30th, 1884.

S. R. LOVETT, L.R.C.P., Treasurer.

Dr.	CASH.	Contra.	G.R.
		<i>£ s. d.</i>	<i>£ s. d.</i>
To Balance brought forward, 1883 ..	.. 14 18 1	1884. Jan. 11 & May 29.	Roberts & Leete, Printing .. 85 13 3
," Subscriptions .. ..	.. 99 18 6	Use of Library, 1, Adam Street ..	.. 7 17 6
		Hire of Room, Charing Cross Hotel ..	.. 1 1 0
		Tea and Coffee .. ..	.. 6 2 6
		Gratuity to Attendant, &c. ..	.. 1 11 0
		Petty Cash .. ..	.. 9 15 7
		Balance .. .. ..	.. 2 15 9
			<hr/> <i>£114 16 7</i> <hr/>

JOHN D. ROWLAND,
A. WYNTER BLYTH, } *Auditors.*

PROGRAMME FOR THE SESSION, 1884-85.

The Secretaries have to announce the following papers, which have been promised for the ensuing session :—

An Inaugural Address by the President.

“*On Noxious Trades,*” by Alfred Spencer, Metropolitan Board of Works.

“*On the question whether Small-pox Hospitals are necessarily a source of danger to the surrounding population,*” by Dr. E. T. Wilson, Dr. Tripe, and Dr. Gwynn.

“*On Sewer Ventilation,*” by W. Weaver, C.E.

“*On the Status of the Medical Officer of Health,*” by H. E. Armstrong, M.R.C.S., Newcastle-on-Tyne.

“*On Sewage and its Treatment,*” by Dr. Thomas Stevenson, F.R.C.P., Guy’s Hospital.

“*On Disinfectants,*” by A. Wynter Blyth, M.R.C.S., Medical Officer of Health, St. Marylebone.

The annual meeting of the Society was held at the International Health Exhibition, on June 11th, when the Treasurer and Secretaries presented their annual reports, and the office bearers for the ensuing year were elected.

The Society received with much regret a letter from Dr. J. Northcote Vinen, resigning the office of Honorary Secretary.

On the motion of the President it was resolved, “That the resignation of Dr. J. Northcote Vinen be received with regret; that the best thanks of the Society be offered to Dr. Vinen for the valuable services which he has rendered for a period of over twenty years, with manifest advantage to its interest, and that the Society desires to convey to him their warm appreciation of his labours and their sincere good wishes for his speedy restoration to health, and for his future happiness and prosperity.”

It was also resolved that the resolutions should be engrossed on vellum and presented to Dr. Vinen.

SHIRLEY F. MURPHY,
CHAS. E. SAUNDERS, M.D. } *Hon. Secs.*

July, 1884.

APPENDIX.

THE FOLLOWING PAPERS WERE READ

BY DELEGATES OF THE SOCIETY

AT A JOINT CONFERENCE HELD AT

THE INTERNATIONAL HEALTH EXHIBITION,

IN JUNE, 1884,

Vide REPORT, PAGE 114.

THE DOMESTIC SANITARY ARRANGEMENTS OF THE METROPOLITAN POOR.

By JOHN W. TRIPE, M.D., M.R.C.P., Ed., &c.

WHEN I was requested to read a brief Paper on this well-worn subject in conjunction with Mr. Ernest Turner, the first question which suggested itself to me was, Who are the poor concerning whom I have to address you? The word embraces a very great variety, I may say not only of persons but of classes; not merely the two great classes of the deserving and the undeserving poor, that is to say, (a) those who are poor from the force of circumstances over which they have no control, and (b) those who are poor from indulgence in vice, and even crime, but also a multitude of others who obtain an honest living as hawkers, costermongers, needle-women, matchbox makers, workers in manufactories, and others. I do not, however, propose to mention the domestic arrangements of any particular class, but to take the word "poor" in its broadest sense as including all those who live in very small houses containing two or three rooms, or in tenement houses when they occupy perhaps only one, it may be two, or at the most three rooms, according to the size of their families. The houses in which many of them live are those to which "Regulations," made under the 35th Section of the Sanitary Act will apply, and differ very much in various parts of London, some being very old with low ceilings, imperfect means of ventilation, rotten floors and staircases; and are also dirty, dark, and generally dilapidated. The sani-

tary arrangements usually correspond with the houses ; the water-closets being dark, foul smelling ; the water supply apparatus frequently defective, the supply generally insufficient ; the cisterns dirty, being rarely cleaned out ; the dustbins frequently broken and full, containing offensive refuse, even excrement, so that it is dangerous to empty them. Houses in this state are frequently occupied by the residuum, many of whom are disgustingly filthy and destructive in their habits. I have seen fairly good sanitary waterclosets so misused as to convert them in a very short time into the most filthy places it is possible to conceive. Persons of this class can scarcely be said to have any domestic sanitary arrangements whatever ; they inhabit certain streets and courts forming colonies, and can scarcely be reformed, except by breaking up and dispersing them amongst a better class, and by repeated appeals being made to their feelings by district visitors and others. The word "residuum" is now generally used to distinguish the lowest classes who have no definite occupation by which to obtain a livelihood.

There is another kind of house, with better sanitary arrangements, much occupied by the poor, viz., that containing five or six rooms, in which two or more families dwell, with rather low ceilings, fairly good sanitary appliances, although generally more or less dirty, but rarely, except when occupied by the residuum, so dirty and dilapidated as the others. To houses such as these the enforcement of the Regulations are of great service, as there is comparatively little difficulty in getting the rooms and passages whitewashed and coloured once a year, and in obtaining fairly good water-closet accommodation, paving and drainage of the yards, and in keeping the water-supply apparatus in good order. The inhabitants of houses of this class, however, often keep poultry, rabbits, &c., in their yards, which is undoubtedly an insanitary arrangement, and should always be prevented if possible.

As very many persons may not understand the powers

given to the Local Sanitary Authorities or the subjects on which Regulations may be made, I will state that by the provisions of the Sanitary Act, 1866, Section 35, the Local Government Board is empowered, on the application of a Nuisance Authority, by notice to be published in the *London Gazette*, to "declare the following Enactments to be in force in the district of such Nuisance Authority, and from and after the publication of such notice the Nuisance Authority shall be empowered to make Regulations for the following matters—that is to say,

- " 1.—For fixing the Number of Persons who may occupy a House, or Part of a House, which is Let in Lodgings, or occupied by Members of more than One Family.
- " 2.—For the Registration of Houses thus let or occupied in Lodgings.
- " 3.—For the Inspection of such Houses, and the keeping of the same in a cleanly and wholesome state.
- " 4.—For enforcing therein the provision of Privy Accommodation and other appliances and means of cleanliness, in proportion to the number of Lodgings and Occupiers, and the cleansing and ventilation of the Common Passages and Staircases.
- " 5.—For the cleansing and lime-whiting at stated times of such premises."

The Sanitary Law Amendment Act, 1874, Section 47, enables Regulations made under the 35th Section of The Sanitary Act, 1866, to extend to

- " Ventilation of rooms,
- " Paving and drainage of premises,
- " The separation of the sexes, and to
- " Notices to be given, and precautions to be taken in case of any dangerously infectious or contagious disease, under the powers of this Act, or of the principal Act, or of the Acts therein mentioned."

The Nuisance Authority (*i.e.* the Vestries and District

Boards) may provide for the enforcement of the Regulations by penalties.

There is considerable doubt in my mind as to the extent to which the Regulations should be enforced in providing and keeping the sanitary arrangements of the poor in an efficient state, as if frequent inspections are made, and the owners or rent-collectors are put to comparatively a large expense, the ordinary rent, which could with difficulty be paid, is increased, and if the additional rent be not paid the tenants are ejected, to carry a bad example elsewhere. In some instances in Hackney occupied by the residuum a whole street has been closed before the required repairs were done ; the rents were raised, and the streets occupied by a better class of poor, when the destructive poor do not return to it. On the other hand, if due regard be not paid to the sanitary arrangements, including periodical cleansing, repair, &c., disease may arise in the streets and spread to the adjoining neighbourhood. Due care must therefore be taken by the inspector that whilst too much zeal is not displayed, yet nuisances injurious to health are not allowed to remain. The position of the landlord or middle-man is often by no means an enviable one, as it is most disheartening for him to find dust-bins broken, the water-supply apparatus damaged, the walls defaced, and his property injured almost immediately after it has been put into good order. If these houses are kept in a good sanitary condition no reasonable rent will pay the cost, so that either the inhabitants must remain for an uncertain period in unsanitary houses, or the destructive poor must be taught by the force of circumstances that they must reform their habits, or else will be driven from house to house, as they cannot pay such a rent as will make them desirable tenants.

Having thus briefly noticed the various kinds of poor with whom we have to deal, and the general condition of their dwellings, I shall now discuss in detail some of their domestic sanitary arrangements, and especially the water-supply apparatus. I do not propose again mentioning

their dwellings, or expressing any opinion on the buildings most suitable for them, especially as what is suited for some is not fit for others (for instance, costermongers with donkeys and barrows), as these subjects fall within the scope of Mr. Turner's Paper, but I desire to express my belief that the Peabody and other similar buildings are not suitable for what I call the poor. I prefer, when the cost of ground is not too high, four, five, or six roomed houses, with an outbuilding for use by the various inmates, as a scullery and washhouse. There are numerous houses of this kind in Hackney which are occupied by the poor, and are provided with fairly good sanitary arrangements. These are kept in pretty good order by an annual inspection, and the subsequent visits necessary to obtain the removal of any nuisances existing on the premises.

The most important of the sanitary arrangements of the poor is the water-supply and water-supply apparatus. In some London parishes the supply is almost entirely derived from what is termed the constant, such as that of the East London Waterworks Company ; whilst in others only a comparatively small proportion is so given. A constant is much preferable to an intermittent supply, as by a trifling alteration of the pipes water can be drawn from the main instead of from a cistern. I am also informed by an engineer to a company that the waste of water is less on this plan, as the fittings differ to a certain extent from those used with an intermittent supply. In many poor houses there is not a cistern when the supply is on the constant. This is objectionable, as when the water is shut off for the insertion of or repairs to the stop-cock on the supply-pipe of adjoining houses, or any alterations or repairs outside this stop-cock, the inhabitants of a whole street are sometimes left without water. Repairs to a pumping-engine also cause the same inconvenience. As many houses in the constant have not even yet a screw-down tap on the supply-pipe, a stoppage in the supply of water is perhaps more frequent than it will be hereafter when these are universally employed ; but after much experience, partly as regards my own

house, I strongly urge the necessity for a cistern in all cases. It is true that when the cistern supplies the water-closet with water, if the pipe and tap connected with it remain in the usual place over the sink, dirty, or otherwise contaminated water, may be used instead of that from the main, but with due care this ought not to occur. I find that the best way of obtaining a supply of good water is to have a length of pipe connected with the supply-pipe before it reaches the cistern, with a screw-down tap placed over the sink, so that water can then be drawn from the main instead of from the cistern. This arrangement has been extensively carried out in the Hackney district amongst the poor, although owners have in many instances made great opposition to it, and indeed in some instances have refused to carry out the suggestion. It is much to be regretted that the powers of the Vestries and District Boards of the Metropolis are not sufficient to enforce a proper water supply for drinking and domestic purposes, as well as for flushing closets. It is true that the cistern which is provided for flushing water-closets, is furnished with a pipe and tap for drawing off water for domestic purposes and for drinking ; but this is not enough, there should be power to compel owners to disassociate the drinking water from that used for other purposes. When the water supply is on the constant this can be done as above-mentioned at a trifling expense, and when it is not on the constant by the intervention of a flushing-box between the cistern and the closet. This however is not, in my opinion, sufficient, as the cistern is often placed in or above the closet, forming part of its roof, as so frequently obtains amongst a majority of the small houses in Hackney and elsewhere. The arrangement is also most objectionable, as the cistern cannot be readily cleaned out, is exposed to frost, and if there be not a water-closet service-box or flushing-cistern, the water may be contaminated by effluvia from the pan, which is often very dirty. Many persons will not believe that air passes into the cistern when the handle of the closet is raised, but I have seen this happen on many occasions, and met with two severe cases of diphtheria in a

large house where none of the other sanitary arrangements were defective.

The flushing-box is often by no means of a satisfactory make or properly fixed, being usually of too thin a material, whilst from its shape it is likely to crack when the contained water freezes, and is also often fixed in so slight a manner as to be readily pulled down. I have often seen it placed so low, to avoid the cost of a couple of feet of down pipe, that children climbed on the seat and interfered with its working. The ball-tap often ceases to shut off the water in consequence of the arm connecting the ball with the tap becoming straightened from use, so that the poor will often put a stick under it to keep the ball up and shut off the water. I have under such circumstances known the pipe to be knocked together, and the closet kept without water for a lengthened period rather than inform the owner. A little grit getting on the leather or india-rubber in the old ball-tap and in the kind of draw-off tap commonly used at present, causes a leak, and consequent loss of water, which might be easily prevented by a more frequent inspection of the water apparatus by the company's officers. I also feel persuaded that if the water companies' officers would take out the defective leathers from the taps, and put in new ones, much waste of water would be prevented. I shall not suggest any make or pattern of flushing-box, as perhaps Mr. Turner will refer to these, but I think I am not going out of the way to mention that a flushing-box fitted with a syphon is a most efficient kind, as it admits of the whole flush being delivered after children or others have used the closet, and have not kept the handle up for a sufficiently long time. This box, if fitted with a down-pipe having an internal diameter of an inch and a quarter, will give a sufficient flush provided at least two gallons are discharged at once. The down-pipe in the poorer class of houses is usually too small, and the handle is not held up long enough for the pan and drain to be sufficiently flushed. This is one of the causes of the drains in poor houses getting blocked up, but as a rule choked pans and drains occur either from neglect, or

too often from stones, tins, sticks, and other things being put into the pan by children. To remove these obstructions it was by no means uncommon for the poker or a stout stick to be taken and the fancied obstruction rammed at until the trap was broken. This is one of the instances in which a little less energy and a little more knowledge would be useful.

There has been a great discussion, which I think has now nearly terminated, as to the relative merits of hand (pail) flushing and a supply of water from a proper apparatus. When poor persons did not generally understand the use of a water-closet (which, by-the-bye, seems but little known to immigrants from rural districts), there might have been some ground upon which those who recommend pail-flushing could stand, but now there seems to be no reason why every water-closet should not have a proper supply of water laid on. There is no doubt that as a rule the closets which have a water supply are rarely so filthy as those that are cleansed by hand-flushing ; and that the proportion of dirty pans is much larger amongst hand-flushed than closets provided with a proper apparatus.

When an intermittent is changed to a constant supply, the size of the ferule in the main, which is usually very small, should be increased so as to admit of a pailful of water being obtained from the draw-off tap as quickly as could be done under the old system from the cistern. This is a matter of considerable importance, as in many cases the owners request the water company's officials to put in a smaller sized ferule than that provided by the bye-laws. This is quite regular provided the owner obtains the occupier's consent in writing, but is probably often done without that formality. The chief object of this is to lessen the strain on the fittings and diminish the cost of keeping the apparatus, especially the draw-taps, in proper order, so as to prevent the waste of water. Numerous complaints were made to me, when the constant service was introduced, of the "dribble" instead of a full stream of water that flowed from the draw-taps. On

the other hand, weak pipes and taps will not stand the pressure attending the use of a full-sized ferule, and much waste consequently results. I find that an eighth-of-an-inch ferule, if the pressure at the waterworks be good, and the house be not on an elevated part of the district, affords as good a supply as is ordinarily required, except perhaps by washerwomen. Water-waste preventers, which discharge a pailful of water each time, are extensively used in the poorer courts of Whitechapel and some other parishes instead of cisterns. The plan answers well in most cases, and as the water is obtained direct from the main, there is no fear of contamination, but they are objectionable in consequence of the time occupied in filling the receiver after each discharge.

The direct connection so often found to exist between the sink-waste and the house-drain is often injurious, as when the cover of the bell-trap is left off or broken a current of sewer-gas can, and often does, pass into the room. As the room is often used for living in, as well as for cooking and washing, the entrance of sewer-gas, often in a full stream, causes much disease. This sometimes consists only of headache, loss of appetite, malaise, and a disinclination for work, but neuralgia and other ailments frequently occur which interfere very much with the usefulness and enjoyment of life. Indeed I scarcely know of a greater source of discomfort than such sink-wastes. A bell-trap in the sink and other places is often worse than useless, as the cover is usually left off; and even when on they afford no protection, except when full of water, so that in yards and other places where they depend for the small efficiency they possess on an uncertain supply of water from rain or occasional sluicing-down of the yard, they deceive those who trust in them. In Hackney I recommend that a grating of some kind or other be fixed over the opening to the waste in the sink, and that the pipe be carried through the wall into a yard-gully having an opening in it for that purpose. If the room should be so far underground that the pipe cannot be carried through the wall, it is connected with a P.- or

S.-trap. This is not satisfactory, but cannot always be helped. When there is a bell-trap in the sink, and it is left off, and the attention of the occupier of the house is consequently called to it, the inspector is usually considered to be more nice than useful. The heads of the rain-water pipes are, especially in poor houses, often placed near windows, so that sewer-gas can make its way into the bed and living rooms without being suspected. In very many instances cases of severe sore throat have occurred time after time in the same room until this defect has been remedied, when it has ceased to recur. This remark applies with as much force to high-class houses as to those of the poor. Diphtheria, often fatal, also occurs apparently from the same cause, and I have met with typhoid fever in rooms where the pipes were similarly situated. I am in the habit of having rain-water pipes so placed cut off from the drains, and made to discharge the rain-water over or into a yard-gully. The latter is the best arrangement, as the top or grating of the yard-gully in dry weather is apt to become blocked up with drift of various kinds or the holes filled up by children. The latter occurs so frequently, that a few words from district visitors and others to occupiers of poor houses would often be useful.

The paving and drainage of the yard in poor houses are often bad, to a great extent, however, owing to the carelessness of the inhabitants, who often chop blocks of wood on brick or concrete paving, or even on the hearth-stones. The difficulty in many houses of the poor in Hackney is to define absolutely what is the yard, as small houses were often built with gardens behind them, and the owners will not pave any portion of the small garden, and magistrates also object to make an order for them to do so. If all that may be called yard is covered with York or Victoria stone, or even with good concrete and bricks, the cost is comparatively so large that rents are raised, but if they remain unpaved, they are a source of great discomfort to children, and a cause of

dirt in the house. Even when hard bricks have been laid down, the house refuse or garden mould is often thrown on the paving to so great a thickness that it is necessary to scrape the surface before its structure can be seen. It is true that this only occurs amongst dirty people, or in tenement houses where anything that has to be done for the common good is neglected. Regulations made under the Sanitary Act will assist inspectors in their efforts to have yards, water-closets and other places kept clean, but if the person letting the house in tenements will have to do this and other work for the benefit of his tenants, he will increase the rent to pay himself for the time so expended. In carrying out these regulations difficulties have often arisen regarding the amount of work to be done by the owner or middleman, because whilst every thing necessary for the preservation of health must be done, yet more than that should not be asked for, as the tenant is usually made to pay for every improvement. The cost of keeping houses in a cleanly state as regards the walls and ceilings is sometimes undertaken by the occupier of the rooms or the tenant holding from the owner, who is allowed a slight reduction in the rent ; it is amongst these that the greatest difficulty exists in obtaining repairs or even whitewashing. I may say that Regulations have been in force in Hackney and carried out since 1866.

The drains of the houses occupied by the poor, especially when the houses are old, are very often structurally defective, being often made of bricks with open joints from which sewer gas and rats can escape. It is also a very common plan for several houses to be drained through an outlet common to many houses, to save expense and carrying the drain under houses. In practice I find this very objectionable, as the stoppage of the outlet causes great discomfort, and often injury to health, before the obstruction is removed or the outlet reconstructed, and I cannot see what injury to health can accrue if the drains under the houses are of pipes, and laid in concrete. As to brick drains under or near houses, I hold a strong opinion

as to the necessity of their reconstruction with pipes, and being surrounded with concrete, even although they may then be in a sound condition.

The arrangements for the drying and washing of clothes are much better in the comparatively new houses than in the old, as a small washhouse and scullery common to all the tenants for this purpose is usually attached to the house. When there are several families in a house the occupants of a certain room or rooms have the right to use it on a particular day in order that the tenants may not clash with one another, so that the objectionable plan of washing and drying clothes in the living and perhaps sleeping room much more rarely obtains now than formerly. I cannot say much about this in more than two or three parishes, but many years ago, when practising at the East End of London, I have frequently attended sick persons in a room where wet clothes were hanging up to dry. This is most objectionable, not only on sanitary grounds, but because in such cases when the husband comes home to a meal he may find the room little better than a laundry. It is of course more objectionable in a sleeping-room, as the beds and bedclothes are rendered damp by the watery vapour given off in drying, especially as the poor have a great objection to opening their windows for ventilation. The free admission of pure air into their rooms ordinarily forms no part of the domestic arrangements of the poor.

The dust-bins are very often—indeed usually—a source of some discomfort, and I believe sometimes of disease. The poor rarely burn their vegetable refuse, or the shells of crabs and other shell-fish they consume, partly owing to the fires and fireplaces being too small to burn the refuse without creating an offensive smell. Most of the fireplaces are open, very few kitcheners being used, so that if the vegetable and other refuse be not removed every week it becomes offensive, and undoubtedly in summer predisposes to diarrhoea amongst the children who play in the small gardens or back yards. The covers to the dust-

bins, if of wood, are, amongst the residuum, very frequently chopped up and burnt, and the bins themselves are ruined, apparently in many cases out of wanton mischief. The best kind of dust-bin with which I am acquainted is made of iron, $\frac{1}{2}$ th of an inch thick, well riveted together, with strong hinges to the lid, and without a bottom, so that the bin can be lifted off, and the dust, &c., be easily removed. These bins, which will hold about a fortnight's dust, &c., for a small house, are neither easily destroyed nor injured, and are by no means costly. Of course larger ones can be procured. The arrangements for the removal of dust and house refuse are generally by no means good, as the system of asking for gratuities is very common, and acts as a check on its frequent collection amongst the poor. Besides this, in many metropolitan parishes, the contracts are entered into for their removal at a lump sum, so that it is in the interest of the contractor—especially at present, when dust is not saleable—to remove it as rarely as possible. Several of the metropolitan parishes have their own wharves and plant, and employ their own men not only in removing the refuse, but in making it useful for farmers or for sale as breeze. Others, again, hire the necessary plant, &c., whilst one or two, including Hackney, pay for the work being done under the personal supervision of their own officers at a certain price per load, the matters collected being taken to a wharf or shoot outside or on the confines of the parish. In this way, as a ticket is given for each load collected, payment is only made for work done. I am quite aware that the removal of dust does not form part of the domestic sanitary arrangements of the poor, but I thought I should be excused for this very short divergence from the limits of my Paper. I have not referred to the underletting of rooms, and consequent overcrowding; indecent overcrowding; appliances for sleeping in, that is to say, beds, bedding, &c., and many other subjects which might have been discussed, because the time at my disposal would not allow of more than a mere mention of these matters.

DOMESTIC SANITATION IN RURAL DISTRICTS.

By GEORGE WILSON, M.D.

IN opening the discussion on this very wide and important subject of Domestic Sanitation in Rural Districts, my share in it will be confined more particularly to the sanitary condition of the labourer's home and its surroundings, and to village sanitation generally, including water supply, refuse removal, and drainage. I shall also endeavour to point out very briefly to what extent recent public health legislation has enabled sanitary authorities throughout the country to remove or remedy the serious dangers to health which were found to be everywhere prevalent, and to indicate what further changes are required in this direction.

I. Labourers' Dwellings.—Some few years ago it was estimated, and the estimate was considered to be fairly within the mark, that a minimum of one-third of the rural homes in Great Britain were unfit for healthy human habitation, and the magnitude of the financial aspect of the question was represented by the statement, that the enormous number of 700,000 hovels which were occupied as dwellings should be pulled down stick and stone, and 700,000 new cottages erected in their stead at a cost of seventy millions sterling. These figures, it must be admitted, were somewhat startling; but they were based on the Report of the Agricultural Commission appointed in 1867 and other official inquiries, and I very much fear that the evidence which is being collected by the present Royal Commission on the housing of the working classes will show that this minimum of one-third still fails to reach

a fairly healthy standard for a labourer's dwelling in many parts of the country. From Land's End to John o' Groat's there are hovels to be found in mining districts, in lonely glens, and in seaside villages, so wretchedly bad that comfort, health, or decency become alike impossible. Even in that large tract of Warwickshire with which I am officially connected, I found from a house-to-house survey which I instituted when first appointed, that in some of the villages as many as 10 to 15 per cent. of the cottages contained only one sleeping-room, and about one-half only contained two. And in Warwickshire, according to the Report of the Royal Agricultural Commission, the defects in house-accommodation were not nearly so glaring as in many other counties. Indeed, in some parts, I am glad to say that, owing to the initiative shown by not a few landed proprietors, who recognise that they have public obligations as well as private rights, the cottage accommodation is remarkably good. But in my district, as elsewhere, many cottages are so old and dilapidated that they require constant patching up to keep them fairly weather proof ; some year by year lapse into such a rickety condition that it becomes absolutely necessary to close them ; others again, with clay floors on damp sites, can never be considered healthy ; while many are so cramped as regards space that there is the greatest difficulty in disposing of the slops and refuse.

Now, although it is quite true that almost all these defects can be dealt with under the provisions of the Public Health Act, I am afraid that a do-nothing policy has been encouraged in most parts of the country, owing mainly to the appointment of medical officers of health at merely nominal salaries, whose private practice hampers them in the full and fair discharge of their public duties. But speaking for my own and other districts, where the health officers are precluded from private practice, and who can, therefore, encourage and support as well as supervise the sanitary inspectors, I feel warranted in saying that the improvement in the sanitary condition of labourers' cottages

has been very marked, and as considerable as original faultiness in site and structure will allow. For under the wide term "nuisance," we can order the cleansing and whitewashing of dirty houses, the repair of roofs which let in the wet, the opening of closed or fixed windows, the repair of walls and uneven floors, the removal of closets or pigstyes abutting against outside walls, the laying or repairing of drains, the prevention of dampness as far as possible, and in short the abatement of any defect which is reasonably inferred to be dangerous to health. Then, again, whenever it is found that a cottage cannot be put into decent repair, we can obtain an order to close, but this becomes a very serious question where cottages are scarce, because it only tends to increase the overcrowding elsewhere. Fortunately for health requirements, I believe the population is steadily diminishing in the strictly rural parts of the country, otherwise this question of overcrowding in consequence of the closing of dilapidated cottages would become much more serious than it is. But when it is remembered that a large proportion of the cottages which are still considered habitable only contain one sleeping-room, it must be conceded that decency cannot be maintained with a growing family, and that overcrowding, apart from the moral aspects of the question, is common enough. Indeed, the wonder is that with such scanty accommodation, the rural labourers are as moral as they are, and were it not for the chinks and crannies which so freely ventilate their dilapidated homes, the dangers would become much more intensified. In dealing with cases of overcrowding, therefore, it is evident that no hard and fast rules can be laid down. The minimum standard of cubical space must not be made too high, and the ages of the children have to be taken into account. With regard to cubical space, it appeared to me, after careful inquiry into the average amount of sleeping accommodation in my own district, that the standard of 200 feet per inmate was as high as it could be raised for families consisting of parents and young children ; though I am of opinion that a minimum

of 300 cubic feet space, even where good means of ventilation are provided, is little enough for the requirements of health. But in cases where it is found that grown-up children of both sexes sleep in the same room, or in the same room with their parents, the question of cubic space becomes a matter of secondary consideration, and the plea of overcrowding is insisted on in the interests of decency as much as on the score of health. The overcrowding in these cases may be abated by removal of the family to a larger house, or if that is impracticable, by treating the grown-up members as lodgers, and insisting upon their finding suitable lodgings elsewhere.

One of the great obstacles to the improvement of labourers' dwellings in rural districts depends upon the fact that many of the worst class of cottages belong to owners who are really so poor that they can neither afford to build or repair, that others belong to owners who hold them on leases which are nearly expired, and that many of what are called the old parish houses are vested in Boards of Guardians, who, not having the power to build or the funds to repair, are compelled to go into the market and sell the wretched hovels for what they will fetch. Then again, there are many cottages which were originally built on the waste, and for which a merely nominal rent is paid to the lord of the manor. As a rule these are in such a dilapidated condition that they are constantly getting out of repair, and when notice is given to repair or close, it often happens that the lord of the manor prefers closing to repairing, and if no new cottages are built in their stead, the inmates must shift elsewhere.

Another great difficulty in dealing with this question depends upon the fact that the wages of the agricultural labourer do not enable him to pay a rental which would be sufficient to encourage private enterprise in building new cottages, even where land could be readily leased or purchased. A comfortable cottage cannot be built for a less sum than £100, exclusive of site, and the average rent paid by agricultural labourers would not yield a higher return

on this outlay than three per cent. But many old cottages can be purchased at such a cheap rate that after having been put into habitable repair they yield a return of as much as 10 to 15 per cent. on the outlay, so that if sanitary authorities had the power to purchase and repair old cottages, and build new ones in districts where the obligations of landowners in this respect are persistently neglected, I think a vast improvement could be speedily effected without unduly increasing the rates. Indeed, when one sees how little need there is for any interference of this kind on well-managed estates, and how the scarcity and wretched condition of labourers' dwellings have become so pronounced through neglect or indifference on other estates, I frankly confess that I think the land should be taxed for the outlay. But into this part of the subject I need not enter farther. Let me rather refer those who wish to make themselves more fully acquainted with this question of the housing of the poor in rural districts to Dr. Bond's pamphlet on "The Home of the Agricultural Labourer," and to express my conviction that without legislative powers in the direction pointed out by Dr. Bond, it is impossible to mitigate the dangers to health which are more or less persistent in many parts of the country where cottages are very bad or very scarce. But while I admit this legislative necessity, I also admit that great improvements have been effected in districts where the provisions of the Public Health Act have been fairly and firmly enforced, and that nowhere is there any excuse for a do-nothing policy.

Another great impediment to improvement in the house-accommodation of rural districts depends upon the fact that unless the sanitary authorities apply for urban powers, they have got no control over the erection of new cottages, so that jerry-building of the worst description cannot be interfered with, and sanitary evils, more especially in connection with drainage and closet-accommodation, are perpetuated. Indeed, all this is so obvious that it is difficult to conceive why such control over the erection of new houses should

not have been conceded to every rural authority by Act of Parliament without the necessity of applying to the Local Government Board for a provisional order, which always entails delay, and is often dispensed with altogether, even in districts where a considerable amount of suburban building is going on. And this control is much more necessary as regards the surroundings than as regards the actual architectural details of the houses themselves. For example, the provisions of the Public Health (Water) Act which were intended to enforce and protect a wholesome water supply in rural districts are often rendered nugatory by the powerlessness of sanitary authorities to interfere. It is all very well to give a certificate to the effect that the water supply of a new cottage is ample and of good quality, but if a cesspool, or deep midden, or leaky drain, has been constructed in the neighbourhood of the well, it only becomes a matter of time before the well becomes seriously polluted. There ought therefore to be an amendment of the Public Health Act to enable sanitary authorities to enforce bye-laws, not only in respect to new houses, but in respect to the kind and situation of closets, and the proper construction and disconnection of drains. And this applies with equal force to the suburban residence and country mansion. For want of this control over new buildings in rural districts, the most glaring errors and defects in house-sanitation are still committed. Water-closets are erected with the cesspools into which they are intended to discharge often not far from the well ; the closets themselves as regards situation and appliances frequently become a source of danger ; the drains may be leaky, and often are neither properly disconnected nor ventilated ; if the water-closet, as is usual, is supplied with water by means of a force-pump, the cistern which supplies the closet generally also supplies the drinking-water ; the soil-pipe is seldom ventilated, or, if it is, the ventilating-pipe is so small that practically it is of little use ; and should there be a bath-room, the waste-pipe is almost certain to be laid directly into the soil-pipe or into the drains. Money

enough may be lavished on architectural display, but I venture to say that many country architects are still ignorant of the veriest rudiments of sanitation, and hence the great need for extended powers and adequate bye-laws.

II. *Water Supply.*—Although I have no doubt much good has been effected by the provisions of the Public Health (Water) Act, still, as I have already said, the intentions of the Act are often nullified by this inability to interfere with building operations. The usefulness of the Act, too, is limited, inasmuch as it applies only to rural districts, whereas it should be made applicable to all districts, whether urban or rural, not provided with a public water supply. For example, there is a small town in my district which some few years ago severed itself from the union in which it is situated, and was created a local board district, with of course urban powers. But it was without any public water supply, and at the time, none was absolutely needed. The water supply was derived from wells, and as there was a good deal of building going on, I recommended that application should be made to the Local Government Board for a provisional order to enforce the provisions of the Public Health (Water) Act, which it became impossible to carry out so soon as it ceased to form part of a rural district. The application was of course granted, but it should never have been necessary to make it. Then, again, there are outlying parts in almost all urban districts beyond the reach of the water-mains, which are strictly rural, though within urban boundaries. Surely, it is essential that some supervision ought to be exercised over the water supply of houses built in these outlying corners; and yet, though urban authorities have complete control over the buildings and drainage, they have no power to insist on a pure and plentiful water supply within a reasonable distance before granting a certificate of fitness for occupation.

The other provisions of the Public Health (Water) Act, which enable rural sanitary authorities to enforce a supply of wholesome water to existing houses, and to compel the owners of neighbouring houses to provide a joint supply

where necessary, ought to result in much good if honestly and fairly carried out. Where the subsoil water is within easy reach, and it is so in most parts of my district, it is seldom necessary to put these clauses in force, because wells are generally plentiful enough, but the purity of the supply is often endangered by their proximity to deep ash-pits or cesspools, and leaky drains. In such cases, the deep ashpit or cesspool should be regarded as a nuisance dangerous to health, and done away with altogether, and the drains should either be diverted or replaced by open and properly channelled gutters. Sometimes the surrounding soil has become so impregnated with sewage matter that the well must be closed altogether, and a new well sunk in virgin soil, and in these instances the Public Health (Water) Act is undoubtedly of great service. Another source of danger to the water supply of country districts depends upon the fact that the well is seldom puddled to a sufficient depth to keep out surface impurities, nor is the covering so evenly and imperviously laid as to keep out slop water. It very often happens, too, that a well becomes polluted because it is never cleaned out ; indeed, I regard this periodic cleansing of wells so essential that I think every pump-well should be provided with a properly constructed man-hole for purposes of cleansing and inspection, and that the well should be cleansed whenever the water shows any traces of deposit.

I need hardly say that pond or ditch-water, which constitutes the only source of supply to outlying cottages in many parts of the country, should never be regarded as a wholesome supply, and that in all such cases the provisions of the Water Act should be enforced whenever practicable. Open dip-wells, again, are always more or less exposed to pollution, and are specially objectionable when used by more than a single household, on account of the fact that the dip-pails are not always clean.

But in many parts of the country the geological formation is such that wells of any description are out of the question. Villages so situated must be provided with a public water

supply, either by storage of the rainfall, or by taking advantage of some neighbouring stream or spring, or by laying deep land drains or adits. Several villages in my own district are provided with a public supply derived from springs situated on rising ground in the neighbourhood, and I may mention, in passing, that in these villages cases of typhoid fever are practically unknown. In a great many other villages public wells are provided, and special care is taken that these wells are kept in good repair, and beyond risk of pollution.

III. Disposal of Refuse.—This includes the consideration of three very important items in village sanitation, viz. closet accommodation, scavenging, and drainage. At the date of the passing of the Public Health Act, 1872, the closet accommodation in country villages was of every conceivable description, and often a most fruitful source of nuisance and danger to health. In the older villages it was sometimes represented by a rough wooden erection, with a hole dug in the ground to receive the excreta ; or more frequently by a sentry-box looking structure stuck somewhere near the far end of the garden, with a foetid, leaky cesspit behind. Such common privies were often so foul that, even though sufficiently far removed from the house or from the well, they still endangered health, because they could not be used without the risk attending the inhalation of noisome effluvia. In more modern villages, however, and more particularly in suburban districts, the privy and midden ashpit were combined, and, for convenience sake, they were generally erected close to the house and near the well. As a rule, too, the ashpit was made large and deep, so as to permit of huge accumulations,—so deep that, for some time after it was emptied, it continued to be in a filthy sloppy condition, because the surrounding soil drained into it ; it was generally uncovered, so that after every shower of rain putrefactive change was increased ; and, in short, was always more or less of a nuisance, owing to inherent structural faults. Then, again, in the few better-class houses provided with water-closets the most serious defects were to be met with,

not only in respect to the situation of the closet, but soil-pipes were found to be leaky and unventilated, and the closet discharged either into a covered cesspool from which any gases generated could only escape into the house, or it discharged into a village drain which was not constructed to receive excremental filth. Such briefly are some of the more common varieties of closet accommodation to be met with in rural districts, and, although they can all be dealt with as nuisances under the Public Health Act, it must be admitted, they are common enough still. How then, are these defects to be remedied, legally in the first instance, and with a due regard at all times to efficiency and cost? Perhaps I shall best answer this question by quoting from a small pamphlet of mine on "Sanitary Defects in Villages and Country Districts, and How to Remedy Them," published in 1876:—

"Take, for example, the primitive wooden structure with the hole dug in the ground to receive the excreta. As a rule, this kind of privy accommodation is only met with when the cottage itself is old and dilapidated; so that it would be a sheer waste of money to insist on the erection of a new and substantial structure. All that the law demands is to fairly satisfy the requirements of health and decency, and this can be accomplished in the great majority of instances by a very trifling outlay. Let the hole be cleaned out and filled in with fresh gravel or clay, and such other alterations made that a galvanised iron pail or box can be readily inserted beneath the seat to receive the excreta. This, of course, should be regularly emptied into the garden, and to obviate nuisance dry earth or sifted ashes should be thrown into the pail at least once a day, and in sufficient quantity to keep the excreta covered. If the seat is hinged there will be no difficulty in removing the pail or in throwing the ashes into it without dirtying the seat. Or take the old-fashioned privy, with its foetid cesspit behind. This can be readily converted into an inoffensive privy and ashpit combined, by filling up the cesspit to the level of the ground; paving or cementing

the filled area, walling it in and covering it as an ashpit ; raising the floor of the privy a step, and with it the seat ; and placing a flagstone sloping backwards beneath the seat, so that the excreta may be readily covered with the sifted ashes or dry earth thrown into the ashpit. Or the ashpit may be dispensed with, and, after filling up the cesspit, the privy may be readily converted into a pail-closet. To sift the ashes either a common wire riddle may be used, or one or other of the cinder-sifters which have lately been devised. But whatever alterations may be adopted in addition to those required for privacy and ventilation, the great desideratum is to keep the excreta dry and prevent undue accumulation. Large, deep, and uncovered midden-steads, or ashpits, connected with privies are always a source of nuisance. When they are nearly empty the surrounding soil drains into them in wet weather, so that for the time being they become open offensive cesspools, and when full they permit of soakage into the surrounding soil. Every ashpit, therefore, connected with a privy should be little, if at all, below the level of the ground ; it should be cemented or made otherwise water-tight, and should be covered (a sloping tarred wooden covering hooked on to the back of the privy will do) to keep out the rain. Moreover, it should be of limited capacity, to prevent undue accumulation, and thereby necessitate frequent removal of the contents. Sometimes, in order to keep the contents more or less dry, the ashpit is drained ; but, apart from the liability to chokage of the drain and the nuisances arising from the admission of liquid excremental filth, drainage of the ashpit should be prohibited altogether, because, if the ashes do not keep the excreta dry and inoffensive, the system is a failure."

These were the instructions which I laid down for the guidance of the sanitary inspectors in my own district, and it will be seen that every possible latitude is allowed with regard to the way in which nuisances connected with privy accommodation may be removed. In the suburban parts and in increasing villages where new schemes of drainage

have been carried out, the option is given to convert these privies into pail-closets, or into water-closets, but pail-closets are only recommended where there is no difficulty as regards scavenging. The water-closet which is found to answer best in districts where there is no public water supply, is the simple pan-closet, with siphon bend and ventilating shaft, and I always recommend that the slop-water be used for flushing purposes. Of course this applies only to outside closets; where the water-closet is inside the house, it should be provided with proper cisternage and other appliances.

In dealing with closet accommodation in rural districts the Public Health Act confers ample powers on sanitary authorities for enforcing such alterations as are required for the abatement of nuisance, and these alterations can be carried out as a rule without entailing any serious outlay. Nor do I think it necessary to recommend any of the excellent patent earth-closets which have been devised, partly because they add to the expense, and partly, too, because I find that from neglect they do not possess any advantages over the ordinary pail system. In addition to the pail for the excreta, all that is required is a box for the dry earth or sifted ashes, and a small shovel with which to throw them into the pail.

In those rural districts which have obtained urban powers, the bye-laws with respect to the closet accommodation of new houses are now so carefully drawn up that nuisance or danger to water supply is scarcely possible if scavenging is properly attended to. The vast majority of rural districts, however, have not applied for these powers, and without bye-laws they have no control over new buildings, so that the serious defects to which I have referred continue to crop up as building goes on.

But even when the closet accommodation is of a kind to satisfy all reasonable sanitary requirements, it need hardly be said that cleanliness of the surroundings cannot be maintained without due attention to scavenging. The pail system possesses the advantage that it does not

permit of filth accumulating near dwellings, and where there is sufficient garden space the householder should be held responsible for the scavenging. But where there is no sufficient garden space, then I hold that the landlord ought to make arrangements with some one to do the scavenging regularly, or should provide some convenient place on which the householder may deposit his refuse. For exceptional cases such as these, it has been recommended that the sanitary authority should provide a "muck-acre;" but in villages where garden space is so generally insufficient, I think the sanitary authority ought to undertake the scavenging either by contract or otherwise. Judging from my own experience, however, I am of opinion that for the great majority of villages public scavenging is not only unnecessary, but to insist upon it is unreasonable. No doubt a village in which every cottage is provided with a patent earth-closet regularly supplied with dry earth and scavenged by the sanitary authority, ought to be a model village as regards outside cleanliness, but if every cottage has also its garden, I feel sure the manure would be greatly missed, and I question very much whether the scavenging would not be as well done if left to the cottagers themselves. By all means let us insist on cleanliness, but do not let us render the enactments for the removal of nuisances a dead letter by undertaking to do all the dirty work for lazy people, when such work can be readily attended to by themselves. The solid refuse, then, should be disposed of in the gardens where the garden space is sufficient, and where that is insufficient, it must in any case be removed from the premises at stated times, and not allowed to accumulate so as to befoul the air or endanger the water supply. The bulk of serious nuisances with which rural sanitary authorities have to deal refer especially to the reconstruction of the closet accommodation, and the disposal of the solid refuse, and in districts where the provisions of the Public Health Act have been steadily carried out, there is no doubt that the improvement in village cleanliness has been very marked, and this

has been accompanied by a very gratifying reduction in the sick-rate and death-rate from filth-diseases.

But in addition to the disposal of filth and other solid refuse, there still remains the serious difficulty of satisfactorily disposing of the slops and refuse-water, and in villages of any size this implies a system of drainage of some sort. The system which is generally found to prevail is of the following description:—The shallow road drains which were intended in the first instance to carry off the surface-water, and which for the most part are either constructed of common drain-pipes, or loosely laid bricks or stones, have been converted into open sewers by conveying into them the badly laid and open-jointed drains leading from almost every house or group of houses in the village. If there be a water-course near the village, the drainage discharges into the stream by one or more outlets, as the case may be. Should it happen, however, that the village is some distance from the stream, then we find the slops discharging into open ditches by the roadside or into field-ditches in the neighbourhood of houses, and thereby often giving rise to filthy nuisances in every direction. This description, of course, only applies to the worst drained villages, but in almost all of them some of these defects are to be met with. Sometimes the drains lead into a dumb-well, and if there is no well for drinking water near, this is a tolerably safe and ready method of getting rid of slops, but the multiplication of dumb-wells or cesspools in compact villages would always be attended with the greatest danger, and ought to be prohibited as much as possible. In small villages, where the houses are scattered, no general system of drainage is required if the garden space is sufficient; but in compact villages of any size it is essential to get rid of the slops by channels of some sort, and drains should always be preferred to open gutters. So far as the health of a village is concerned, the drainage may be regarded as of two kinds. If the soil is at all damp it should be drained to secure dryness, and if the slops cannot be got rid of without creating nuisance a system of drainage will be required to dispose of

them satisfactorily. But much will depend on local conditions. If the village is stationary or decaying, I hold that no expensive system is required, but if the village is steadily increasing, it then becomes necessary to carry out a complete system which will be ample enough for the growing requirements of the particular locality.

But supposing that a village is fairly well drained, or requires to be drained, how is the sewage or slop-water to be ultimately treated? That, too, will depend very much upon local circumstances. If the village drains into a large stream without creating any nuisance, and the stream is not used for drinking purposes lower down, there is no sanitary reason to interfere; or if the village drains into one or more open field ditches, sufficiently far removed from houses or roads, catch-pits will generally suffice; but if there be nuisance at the outfall or risk of water pollution, then the sewage should be purified if possible by irrigation or sub-irrigation. But in whatever way the slops be ultimately disposed of, it is essential that they should be conveyed by one or more outlets to a safe distance, and not be allowed to accumulate in stagnant ditches by the road-side, or in back gardens, to pollute the air by the foul smells which they emit, and endanger the water supply.

Then, too, I think that sanitary authorities should have the power of preventing water-closets from draining into surface-drains in small villages, and of excluding all liquid refuse from slaughter-houses or other places which might tend to increase the outlay in drainage, and very much increase the difficulty of dealing with the sewage at the outfall.

There are many other phases of sanitary work in rural districts on which I should like to dwell, but I trust those upon which I have touched will afford ample scope for profitable discussion. While there is abundant evidence that sound sanitary progress is being made in some parts of the country, it must also be admitted that in large tracts the provisions of the Public Health Act, and other Acts applying to country districts, are still in abeyance,

and this, as I have already said, is in great measure owing to the general want of a properly organised public health service. Medical officers of health should be trained men, and be debarred from private practice, while surveyors and sanitary inspectors should hold a certificate either from the Sanitary Institute or some other examining body as to their fitness to discharge the duties required of them. But in addition to independent and well-qualified officials, we want extended legal powers for rural districts;—powers to purchase and build in parts where it can be proved that the cottage accommodation is alike bad and scanty, and above all we want urban powers with suitable bye-laws to control building operations, and prevent the sanitary defects which are continually cropping up, whether it be in the erection of cottage, homestead, or country mansion.

INDUSTRIAL DISEASES.

By JOHN SYER BRISTOWE, M.D., F.R.S.

THE investigation of the causes of disease is a subject which has ever engaged, and still engages, the choicest intellects in the profession of medicine. For not only does it present the highest scientific fascination, but it is fully recognised that it is in the discovery of the causes of disease that our best hopes of dealing successfully with diseases, either in curing, in mitigating, or in preventing them, reside. When it was proved that scurvy, that direful scourge of sailors in bygone times, was due simply to deprivation of vegetable food, both the means of preventing it and the method of curing it became obvious.

When once it was established that certain fatal infectious diseases of the lower animals were due to specific vegetable organisms, which could be separated from the tissues of the body and cultivated apart from them, the possibility naturally suggested itself that by appropriate methods of cultivation they might be so far robbed of their virulence as to impart or inoculate milder forms of disease, which (in accordance with the analogies afforded by the relation of cow-pox to small-pox, and the protection which one attack of any infectious fever generally gives against subsequent attacks of the same disease) should hold their subjects harmless for the future. I need scarcely remind you of the brilliant results which, by the skilful pursuit of this idea, M. Pasteur has achieved in relation to the anthrax fever of cattle and chicken cholera, or remark on the promise which they give that other human diseases besides small-pox shall some day be robbed of much of their loathsomeness and danger. When also it became apparent that septicæmia and pyæmia, the frequent causes of death after accidents, after operations, and in the lying-in room, were due alone to the inoculation of the system through the wounded surfaces with the septic organisms or bacteria, which abound everywhere and are the agents in putrefactive processes, the need of absolute cleanliness and of the most careful protection of susceptible parts from accidental inoculation from without followed as a corollary. And the introduction of so-called Listerism into surgical practice has deprived the gravest operations of much of their danger, and has rendered possible the frequent successful performance of operations which formerly one scarcely dared to attempt.

As civilisation has advanced, and manufacturing and other processes have developed in order to meet the growing wants of mankind, dangers formerly unknown have arisen, accidents of special kinds have become common, and diseases new to our nosology have sprung up amongst us—accidents and diseases dependent on the new conditions under which, in certain circumstances, men have found themselves placed. I do not, of course, mean to say that civi-

lisation has tended to increase sickness and shorten life, for the reverse of this is known to be the fact. No doubt many causes of disease and injury to which our savage, or less civilised, ancestors were exposed, have wholly or in part ceased to be operative, and by so much have we been the gainers ; but, none the less, new and often unsuspected sources of mischief have from time to time appeared in association with conditions, mainly beneficial, determined by our progress in art, in science, and in luxury.

Among the dangers here referred to must be included : first, accidental injuries, such as mining accidents, accidents caused by machinery, accidents due to the ignition of explosive compounds, and the like ; second, the dangers arising from the temptations to which special occupations expose the persons engaged in them, such as those of alcoholic intemperance incidental to potmen and commercial travellers ; and third, diseases due to poisonous or other influences incidental to certain occupations, and which can only be escaped, if escaped at all, by the adoption of special precautionary measures. It is this last subject with which alone I have to deal on the present occasion.

One of the most interesting groups of industrial diseases is that in which injurious effects arise from the slow action of metallic or other inorganic substances, or their derivatives, upon the system.

Chronic lead-poisoning.—Metallic lead is probably inert ; and even its salts, though generally regarded as poisons, may, for the most part, be taken even in large quantities without material injury to the taker. It is very different, however, with respect to the salts of lead habitually received into the system, even in minute proportion. It would be difficult to enumerate all the conditions under which chronic lead-poisoning is apt to occur. All those who have to do with metallic lead, such as lead-miners, plumbers, type-founders, and manufacturers of lead toys, occasionally suffer. All persons concerned in making glass, in glazing pottery

and the like, in which operations the oxides of lead are employed, are liable to become affected. But the chief sufferers are those who manufacture, or employ in their work, the carbonate of lead ; especially therefore, painters, plumbers, glaziers, glazed-card manufacturers and lacquerers. It is important to note, however, that lead-poisoning is not limited to operatives in lead, but that, owing to the extensive employment of this metal and of its derivatives, the general public are by no means free from danger ; and that isolated cases, or groups of cases, of plumbism, referable sometimes to the drinking of water stored in lead cisterns, sometimes to the use of hair-washes or cosmetics containing lead, sometimes even to the long-continued employment of lead as a medicine, and to other sources of contamination which need not now be specified, are often brought under the notice of medical men.

The symptoms of chronic lead-poisoning are for the most part very striking, and generally quite unmistakable. The most common, and on the whole the most important, are a peculiar form of affection of the bowels, and a peculiar form of paralysis. Lead colic (as it is termed) is usually the earlier in its advent. It is characterised by intense gripping abdominal pain, coming on in paroxysms, and associated with hardness and retraction of the abdominal muscles, nausea or sickness, and almost insuperable constipation. Lead palsy, in its simplest form, attacks those muscles of the forearm which extend the wrist, the thumb, and the first joints of the other four fingers, so that when the forearm is held out prone the hand drops powerless at the wrist, and the fingers droop so as to form nearly a right angle with the rest of the hand. This condition is known as "dropped wrist." Further the affected muscles are tender and irritable, and rapidly waste. The palsy, however, is not in all cases confined to these muscles. Sometimes the upper arm suffers as well as the forearm ; sometimes the muscles of the legs are implicated ; and occasionally indeed the muscles of the trunk, including those of respiration, become involved. But, besides these chief

consequences of chronic plumbism other phenomena due to the same causes are observed. A peculiar form of cachexia, characterised by anaemia or bloodlessness, a sallow or earthy tint of the skin, derangement of the digestive organs and debility, is generally present in a greater or less degree ; and in connection therewith may be mentioned the fact of the occurrence of a characteristic blue line along the margins of the gums at their junction with the teeth. Occasionally also, late in the progress of the disease, blindness, epileptiform fits, dementia, or some other form of madness makes its appearance. A curious but very important fact was observed by Dr. Garrod some years ago, and its truth has been confirmed by subsequent observers, namely, that there is a remarkable relation between gout and chronic lead-poisoning ; that the victims of the latter affection become disproportionately liable to gout, and that persons of gouty tendency are specially prone to suffer from exposure to lead.

The immediate cause of the various phenomena above described is the entrance of lead in some one of its forms into the system ; its deposition in the tissues ; and its specific deleterious action on the organs which chiefly suffer. The poison gains access either by the respiratory organs, owing to the inhalation of vapour or dust ; or by the stomach, in consequence of the impregnation of food or drink ; or, possibly also, in certain cases by cutaneous absorption.

In most instances the injurious effects of lead are readily recovered from if the case be taken early, and if the sufferer give up the employment which exposed him to danger. If, however, he persist in exposing himself, either the colic may prove fatal, or the paralysis becomes established and spreads ; and finally he dies either from the effects of cachexia, from extension of paralysis to vital parts, or from the supervention of symptoms of cerebral disease.

It is probably impossible that workers with at any rate some forms of lead should be rendered wholly free from liability to lead-poisoning. But it is clear that much may be done to minimise danger. "The first principles in lead-works

are the inculcation of cleanliness; avoiding eating with unwashed hands, or in working clothes, or in workshops; moist-grinding; free ventilation; precautions against dust rising, or wearing flannel respirators when this is unavoidable; with occasional doses of sulphate of magnesia, acidulated with sulphuric acid." Similar precautionary measures should of course be taken by painters, and by all who are habitually exposed. It is seriously worth while for those who inherit a tendency to gout to consider twice before entering upon occupations which expose those who follow them to lead-poisoning.

Chronic copper poisoning.—Pure copper, like pure lead, is probably inert. But the salts of this metal are much more poisonous than those of lead; and acute poisoning by them is not only characteristic in its symptoms, but liable to end fatally. It is somewhat curious, therefore, that characteristic poisonous effects from the long continued absorption of cuprous compounds are not nearly so common as those due to lead, and indeed that by some their occurrence is denied. It is certain that copper salts gain entrance into the system by the same routes and methods as lead salts, that they become deposited in the tissues, and that a characteristic greenish or purplish line, somewhat resembling that due to lead, is apt to appear at the edge of the gums. But here all positive knowledge ceases. It is said, and seems not improbable, that workers exposed to the fumes or dust of cuprous salts are liable to suffer from nausea, sickness, diarrhoea, and other symptoms of gastro-intestinal irritation. And there is good evidence that brass-founders are subject to periodical febrile attacks in which colic, or intestinal disturbance, is followed by rigors, and to which the name of "brass-founders' ague" has been given. But it is held that the symptoms are due, not to copper, but to the zinc or arsenic, which is combined with the copper. The subject of chronic copper poisoning derives a special interest from the fact that copper is, or perhaps I should rather say has often been,

designedly mixed with pickles and preserved vegetables to give them colour. I believe that no clear evidence has yet been adduced of the injurious effect of copper taken under such circumstances. Nevertheless, it must always be borne in mind that copper salts are poisons ; that, if they be taken accidentally in excess, acute and even dangerous symptoms may result ; and that hence it is probably as important, in the case of copper as in that of lead, that those who are exposed to danger should adopt the precautions of cleanliness, and the like, which have already been specified.

Chronic arsenical poisoning is not uncommon in consequence of the inhalation of arsenical vapours or arsenical dust. "Those who are chiefly exposed to this form of poisoning are persons employed in the manufacture of pigments, paper-hangers and decorators, artificial flower manufacturers, milliners, persons exposed to the fumes of heated metals, particularly zinc and brass, manufacturers of dyes and leather-dressers." Further, persons living in rooms papered with arsenical paper are very liable to suffer. The substance to which chronic poisoning is mainly due is arsenite of copper, commonly known as Scheele's or emerald green, which was formerly largely used as a pigment, and is still thus used to some extent. Dr. Guy, in the year 1862, investigated the effects of this preparation as they were shown in the industries in which they were chiefly employed, and ascertained that it was mainly in connection with the colouring of paper and of artificial leaves, fruits and flowers, that chronic poisoning occurred. The main symptoms are congestion or inflammation of the conjunctivæ, with intolerance of light and œdema of the eyelids ; a sense of heat and tightness in the throat ; a feeling of heat and pain in the pit of the stomach ; together with more or less feverishness, thirst, loss of appetite and nausea. Following on these, or associated with them, may be developed salivation, sickness and diarrhœa, dryness of skin, with erythematous or eczematous eruptions, œdema

of the extremities, nervous disturbance, feebleness and tremor of the limbs, gradual emaciation, and finally death. The disease, however, rarely proves fatal, inasmuch as its nature is generally recognised long before the symptoms have become dangerous, and the proper means of arresting it have been adopted in time. Yet occasionally the symptoms (which are liable to variation) are misleading ; and if at the same time the source of poisoning be not detected, serious consequences are likely to ensue. It may be added that cutaneous symptoms are among the earliest and most common of the effects of arsenic, being produced by local irritation, and that, although not generally dangerous, they are a source of infinite discomfort and annoyance. There seems to be no doubt, on the other hand, that persons may readily accustom themselves to the habitual use of arsenic in increasing quantities, until so much is taken at a time as would poison any ordinary person, and that under such circumstances not only are there no symptoms of poisoning, but the health and strength and complexion are all improved. The chief evidence in relation to this subject (and the evidence appears to be unimpeachable) comes from the arsenic works of Styria and some parts of Austria. No doubt amongst arsenical workers cleanliness is of great importance—not improbably improvements in process of manufacture have been, and may be, made beneficial to the workpeople ; but as a general rule those who are specially liable to suffer, and those whose exposure is only accidental, will do wisely to escape danger by its avoidance.

Chronic mercurial poisoning.—The per-salts of mercury, like all preparations of arsenic, are very potent irritant poisons. And all salts of mercury, after having been taken for a longer or shorter time, produce characteristic effects, the most prominent of which are salivation, swelling and tenderness of the gums, loosening of the teeth, and foetor of breath, in association with more or less cachexia, and disturbance of the digestive organs. Further, ulceration and gangrene

of the parts about the mouth are apt to ensue. But chronic poisoning occurs among the workpeople who are habitually exposed to the vapour or dust of mercury, or its salts, especially, therefore, amongst those employed in quicksilver mining, water-gilders, the manufacturers of looking-glasses, barometers and thermometers, furriers and persons engaged in the packing of furs, which have been brushed over with solution of nitrate of mercury. Yet, curiously, although such persons may present the symptoms commonly observed in patients who have been subjected to mercurial treatment, for the most part their symptoms are of quite a different character, being of a paralytic nature, and referable to the nervous and muscular systems. The condition is, in fact, known by the name of metallic, or mercurial, tremor. The first signs of its presence are :—a general tremulousness of the hands and arms, which comes on gradually ; numbness, and tingling in the hands and feet ; and occasional pains in some of the joints. Such symptoms are common amongst workpeople exposed to the vapour of mercury, and may continue for years without materially interfering with their capacity for work or their general health. But, sooner or later, they tend to get aggravated ; they not only become more violent, but gradually extend to all parts of the muscular system, so as to involve at length hands, arms, legs, head and neck (including the muscles of expression, speech, and swallowing), and trunk, with the muscles of respiration. Then the violent trembling of the hands and arms renders the sufferer incapable of using these organs ; he cannot lift a glass of water to his lips, or feed or dress himself ; the agitation of his legs becomes so great that he is unable to walk without being supported on either side ; the convulsive action of the muscles of the head and neck causes constant tremulous movements of these parts, while that of the muscles of expression reveals itself in grimaces, and that of the lips, tongue, and muscles of mastication causes tremulous and indistinct utterance, and difficulty in chewing ; the involvement of the respiratory muscles induces dyspnœa.

These convulsive movements are generally absent when the patient is making no muscular effort ; but sooner or later they do not wholly cease even when the patient is in bed or asleep. And at length, possibly, as in the later periods of lead palsy, vertigo, headache, loss of memory, delirium, epilepsy, or distinct paralysis comes on. It is remarkable that the symptoms above enumerated are by no means necessarily associated with other indications of mercurial poisoning, or signs of ill-health. But such symptoms sometimes attend the onset of the palsy, or arise during its progress ; and probably always towards the end the patient gets sallow, emaciated and weak, loses appetite, and presents a general failure in his corporeal functions.

In order to prevent the occurrence of mercurial tremor the same rules with respect to ventilation and cleanliness as have been laid down for workers in lead should, of course, be followed. It is probable, too, that in some of the occupations which entail exposure modification of process might be advantageously introduced. But it is quite certain that all persons who are habitually exposed, as some of the workers must be, to mercurial fumes, are liable to suffer. Fortunately for them, if they be treated early, and especially if they give up their dangerous occupations, a cure is probably always possible.

Chronic phosphorus poisoning.--Shortly after the introduction of phosphorus in the manufacture of matches, it began to be observed that a peculiar affection of the jaw was apt to come on in those who were engaged in the match factories. The first person to call attention to the subject was Dr. F. W. Lorinser, of Vienna, who in 1845 published an account of twenty-two cases of jaw disease, of which the earliest had occurred as far back as 1839. In 1847 Drs. Von Bibra and Geist published jointly an elaborate work on the subject, in which they gave an analysis of sixty-eight cases, which up to that time had occurred in Germany. During the next few years many cases of the

disease were recorded in England, France, and other countries, and several works on the subject were published. And in the year 1862 it fell to my lot to make, for the Medical Officer of the Privy Council, an exhaustive report on the subject, so far as it related to the phosphorus industry in England. I ascertained at that time that at least sixty-one cases of the disease had happened in this country ; and that, without exception, all the cases had occurred amongst the operatives in match factories.

The disease consists in a slowly progressive inflammation of the periosteum of the under or upper jaw, or both, resulting sooner or later in the necrosis or death of the bone, which ultimately (if the patient survive so long) is thrown off, or comes away. The patient, in fact, loses the whole, or a part, of the upper or lower jaw, as the case may be ; and, besides incurring all the distress and danger which attend a long-continued, foul, and enfeebling disease, emerges from his malady permanently, and often hideously deformed. I quote the following account of the affection from my report just referred to :—“The disease, it was noticed, began usually with aching in one of the teeth. At first this was probably mistaken for an ordinary toothache, and would indeed at times intermit. Sooner or later, however, recurrence of pain necessitated the extraction of the tooth, and the pain and annoyance for a time probably ceased. The wound in the gum, however, was found not to heal ; offensive matter began to ooze from it, and ere long a portion of the alveolus became exposed. Occasionally the portion of bone thus denuded came away, bringing with it, perhaps, one or two of the neighbouring teeth, and the disease made no further progress. More frequently, however, the disease continued to spread, and, sometimes slowly, sometimes rapidly, more and more of the jaw-bone became denuded ; the gums grew spongy and retreated from the alveoli, the teeth got loose and fell out, the foetid suppuration became more and more copious, the soft parts around grew swollen, tender and infiltrated, and often the seat of sinuses. And thus the disease continued

to progress, till in the course of six months, a year, two years—it might be even five or six years—the patient sank from debility, or from phthisis, or from some other consequence of the local affection ; or, having lost piecemeal, or in the mass, large portions, one-half, or even the whole, of the upper or lower jaw, returned to his original state of good health, but the victim of a shocking and permanent deformity. During the earlier and more acute stages of the disease, constitutional disturbance, as might be expected, generally showed itself, indicated by febrile symptoms, loss of appetite, thirst, constipation, a sallow, pasty condition of the skin, and these were often associated with intense pain in the affected parts, and consequent sleeplessness. After a while, however (especially in cases that were tending to a favourable issue), pain and constitutional symptoms diminished, and the patient sometimes recovered the aspect of health, even while necrosis of the jaw was still progressing."

The disease occurred only amongst such as were largely exposed to the fumes of phosphorus, and was generally confined to those whose duty it was to dip the matches in the melted phosphorus paste. Occasionally, however, in crowded and ill-ventilated factories, others besides dippers were affected. It was clear (although that point has been disputed, and was not originally held) that the disease was due to the local influence of the phosphorus fumes, and not to constitutional contamination ; for there was no evidence whatever that persons exposed suffered in the slightest degree in their general health ; and indeed the subjects of the phosphorus necrosis were always in good bodily health, until they began to suffer from the injurious effects of their local malady. It was thought by many that the disease only attacked those who had decayed teeth, and that the phosphorus exerted its immediate influence upon them. This view, however, was not entirely confirmed by observation. It seems, indeed, that, though the malady affected in largest proportion those with carious teeth, the special condition which made persons liable to

attack was soreness or ulceration of gum, no matter how produced.

In speaking of phosphorus necrosis, I have spoken mainly in the past tense, because, although not improbably it even now prevails in some parts of the world, and especially in overcrowded, ill-ventilated factories in which the cheaper forms of matches are still manufactured, I believe that owing to the precautionary measures which have been adopted, and especially to the large use of the amorphous phosphorus, which yields no injurious vapour, the disease has largely, if not entirely, disappeared from among us. At any rate, very little has been heard about it for some years, and no case has come under my own observation.

Effects of irritants applied to the skin.—From the group of affections just considered, due to the poisonous action of certain mineral substances, to which in various industrial processes workmen become exposed, I pass on to give a brief consideration to the direct irritating influence on the skin of certain matters which are generally regarded as inert, and in fact generally are inert. It is well known that grocers, bakers, washerwomen, and others, are liable to inflammatory affections of the skin, mainly and primarily of the hands, commonly known as grocer's itch, baker's itch, washerwomen's itch, and so on. These affections are not itch in the proper acceptation of the term, but eczema, or a variety of eczema, induced and kept up by the irritant effects in the first case of sugar, in the second of flour, and in the last of soap, or rather of imperfectly made soap or of the soda which is so constantly employed in washing. Most persons are acquainted with the fact that some delicate and irritable skins are readily irritated and inflamed by even the purest soaps. Common soaps, in which alkali is in excess, or the ingredients are insufficiently mixed, are injurious to most skins. It is a phenomenon of the same kind which washerwomen at times present; but the simple irritation of the skin tends to become, in consequence of the constant use of soap and soda, a veritable

inflammation of the skin, and before long results in vesication and excoriation. The above eruptions, which present little difference among themselves, are of course readily cured by the avoidance of the conditions to which they are due.

In relation with this subject I may briefly refer to two other kinds of skin disease which are determined by occupation, the one the so-called "*chimney-sweeper's cancer*," the other a somewhat analogous disease, sometimes termed, though inappropriately termed, *verruca necrogenica*, or, if one may translate the name into English, *the dissector's wart*.

In former days, when chimney-sweepers used to go up chimneys, and their occupation led to their being constantly begrimed with soot, it was observed that they not infrequently became the subjects of a form of cancer of the skin now commonly known as epithelial cancer or epithelioma. This disease is not special to chimney-sweepers, but in them it affected parts of the body which are not usually attacked in other persons ; and the relative frequency with which it was observed in them acquired for it from the distinguished surgeons who first observed it the distinctive name which we have quoted. I believe that what was called chimney-sweeper's cancer is very rarely met with now, and that its infrequency is due to the practical discontinuance of the conditions which were believed to engender it.

The dissector's wart is special to persons whose hands are constantly employed in the dissection or cutting up of dead bodies. Hence it is common among persons engaged in pathological researches, in those who frequent dissecting-rooms, and I believe also it is met with among butchers and knackers. It is a curious kind of circumscribed thickening of the knuckles, associated with the formation of pits or excavations, and the accumulation of crusts or scabs on the surface. The affection slowly spreads, and, so far as I know, never dies out, unless either it be destroyed by strong caustic applications, or the sufferer renounce the duties which first excited it.

Effects of irritants applied to the lungs.—But the irritant effects of matters which are not poisonous are not limited to the skin. Occupations which habitually expose the workmen to the inhalation of abundant solid particles, that are incapable of solution or removal by the animal tissues or secretions, in many cases induce chronic diseases of the lungs, which are known as the asthmas or consumptions of the several occupations referred to, and tend very materially to shorten life among those engaged in them. Workers in coal-mines and in copper-mines, grinders, mill-stone makers, and flax-dressers are perhaps especially liable to suffer from such causes. It is marvellous how tolerant the bronchial tubes and lungs are of foreign particles which are drawn into them with the breath. Wherever smoke impregnates the atmosphere, as in London and other manufacturing towns, its particles are conveyed in greater or less abundance into the lungs ; whence some are expelled with the expectoration, which presents, consequently, a slaty or black appearance, while some get absorbed, and, becoming deposited in the tissues of the lungs, produce in them that black mottling which increases with advancing years, and is well known to pathologists. Yet, as a general rule, the soot-studded organs remain practically healthy, and no clinical evidences of pulmonary disease manifest themselves. The same remarks doubtless apply to the inhalation of the silicious particles of ordinary dust. The effects are different, however, when such matters are inhaled in large excess. In coal-miners the lungs occasionally become almost as black as coal ; and the excessive accumulation of carbonaceous matter induces a chronic inflammatory condition of the organs, associated with induration, and occasionally with the breaking down of the pulmonary texture. Among copper-miners something of the same kind occurs ; but in this case the sooty matter is associated with a large proportion of silicious particles, which are far more irritating than simple carbon, and more rapidly induce chronic inflammatory changes than it. In grinders and mill-stone makers, the inhaled particles are mainly stony

or silicious particles, and the injurious effects ensue with greater rapidity. Among flax-dressers the pulmonary mischief is of the same kind. It appears, indeed, that the particles which are absorbed exert no specific influence ; that whether they be carbonaceous, silicious, or of any other nature, their effects are simply irritative, and to produce chronic inflammation or fibroid change ; and that the only appreciable distinctive characters are such as are due to the quality of the particles imbedded in the lungs, and to the greater or less rapidity of progress of the disease. The symptoms under which the sufferers labour have some resemblance to those of chronic phthisis, some to those of chronic bronchitis and emphysema, for either of which they may well be mistaken. They consist in gradually increasing shortness of breath, lividity of surface, feebleness of circulation, and cough, with more or less abundant expectoration ; to which, at a later period, general dropsy and hæmoptysis may be superadded. There is generally a total, or almost total, absence of fever. The only methods, so far as I know, by which the irritative diseases of the lungs just considered can be lessened or prevented, are by providing good ventilation, and (when possible) by adopting methods to prevent the diffusion of particles or dust in the atmosphere which the workmen have to breathe. It is obvious, too, that since the diseases are insidious in their progress, and increase in proportion as the inhaled particles accumulate, it would be well for persons who present early traces of them to seek at once some other kind of employment. Much of our knowledge of the subject just considered is due to the labours of Dr. Headlam Greenhow.

Phthisis in connection with sedentary work and defective ventilation.--But, quite apart from the inhalation of solid particles which irritate the lungs into disease, it is certain that many occupations tend to the production of pulmonary phthisis and fatal bronchial affections. I will quote the remarks made by Mr. Simon, in reference to information which his inspectors had obtained concerning the lives of

straw-plaiters, lace-makers and glovers at Berkhamstead, Tring, Towcester, Newport Pagnell, Nottingham, Radford, Barford and Yeovil ; the lives of watch-makers at Coventry ; the lives of button-makers, jewellers, and various knick-knack makers at Birmingham and Sheffield ; the lives of stocking-makers at Lincoln, Nottingham, Radford, Basford and Hinckley ; the lives of pottery artisans, especially of the decorators of earthenware, at Stoke and Wolstanton ; and the lives of factory operatives employed on cotton, silk, flax, and wool at Preston, Leeds, Bradford, Pateley Bridge, Macclesfield, Leek, Stroud, Melksham, Coventry, and Blackburn. “The concurrent testimony,” he says, “of these most various illustrations is—that commonly, where many persons are employed together at any indoor industry, the ventilation of the work-place is likely to be so bad as to convert the employment, which perhaps is not in its own nature of hurtful tendency, into an employment seriously dangerous to health. Here lies the explanation of a fact most deplorable for the working classes of our country—that, *in proportion as the people of a district are attracted to any collective indoor occupation, in such proportion, other things being equal, the district death-rate by lung-diseases will be increased.* For the bad ventilation which, as a rule, belongs to the place of employment, tends to develop among the workpeople a large excess of phthisis, and probably also some excess of other fatal lung disease.” It was further proved, by evidence obtained by Dr. Edward Smith in reference to printers and tailors, and by Dr. Ord in reference to dressmakers, and published in the appendix to the report from which I have been quoting, that the mortality from pulmonary diseases was also very high among them. Dressmakers appeared to suffer least ; but printers, and above all tailors, whose hours of work were much prolonged, and whose work was largely conducted in over-crowded, ill-ventilated apartments or workshops, suffered severely. The document from which I quote appeared just twenty years ago. It is probable that in many cases much sanitary improvement has taken place since then.

Spread of infectious fevers in connection with certain industries.—There are a few occupations which render those who carry them on liable to contract infectious diseases accidentally brought to them by what are technically termed *fomites*, that is, by articles which have become impregnated with, or contaminated by, the virus or poison of the diseases in question.

Seeing how virulent the contagia of most infectious diseases are ; how they cling to clothing, to wall-papers, to filth, and even to most things brought into relation with them whose surfaces are porous or rough ; how such diseases are apt to be conveyed by healthy persons passing between the sick and those who are susceptible, by the transmission of articles of apparel, by books, by letters, by milk, and other articles of food, and in many ways, some of which are scarcely suspected ; it seemed reasonable to believe that the spread of disease might be due in no inconsiderable degree to rags collected here, and imported, for the purposes of paper-making. In the year 1865, I made an extensive inquiry into the question of the spread of infectious diseases by rags, and more especially among the workpeople engaged in paper-making. The result was to a considerable extent reassuring ; for it appeared in the first place that no diseases special to foreign countries had ever been introduced amongst them by the agency of foreign rags, and that as regards native rags the only disease that was ever spread by them was small-pox, and this only rarely. A recent inquiry by Dr. Parsons has, in the main, confirmed the conclusion at which I had arrived, but shows, I think, that small-pox is somewhat more frequently spread by rags than my own inquiries had led me to believe. There are many reasons for the comparative safety of the rag trade which I need not now discuss.

But the most interesting facts, in relation to the spread of infectious disease by the use of materials impregnated with morbid virus, are those which have been collected during the last few years, in reference to the affection known in Bradford as the “wool-sorters’ disease.” I may

state at once that this has been ascertained to be the anthrax fever, or splenic fever of cattle—a very fatal bovine disease, which prevails in many parts of the Continent, and also in Asia and America, and is known to spread readily from cattle to other animals, and to man. Anthrax fever is one of the few diseases which have been clearly proved to depend on the entrance into the system, and the growth in it, of specific forms of living vegetable organisms, or bacteria ; and it will, perhaps, be recollected that it is one of the affections the virus of which M. Pasteur claims to have attenuated, or rendered less virulent by cultivation, so that by inoculation of animals with the cultivated products a mild form of the disease is imparted which protects from future more virulent attacks. The disease has some resemblance to glanders in the fact that it commences sometimes as an external or superficial disorder, sometimes, like most other specific fevers, as an internal or constitutional complaint. In the former case an inflammatory swelling arises on some part of the surface exposed to the air, which is attended with much redness and brawniness of surface, and in the centre of which soon appears an area of gangrene, or sloughing. This affection is commonly known as malignant pustule. In some instances the disorder remains purely local, and recovery takes place with the subsidence of the local mischief. But not infrequently death ensues, either from constitutional disturbance due to the severity of the local inflammation, or with the usual symptoms of constitutional anthrax. The internal form of the disorder is the more common, and also the more fatal. Its period of incubation is uncertain. At its commencement the patient complains of feverishness with weakness, chills, and usually perspirations. After a short time the symptoms become almost suddenly aggravated ; the temperature rises, the pulse and the respirations become rapid, difficulty of breathing, with precordial anxiety, comes on, the surface gets cold and livid, and the patient falls into a condition of prostration or collapse. Sometimes there are signs of local congestions of the lungs, or of

the abdominal organs, and hæmorrhages are not infrequent ; and very often delirium, coma, and even convulsions occur before the fatal termination. The disease is fatal in large proportion, and death usually ensues in the course of four or five days.

Now anthrax fever has never prevailed as an epizootic in this country, and British medical practitioners and veterinary surgeons have as a rule had no experience of it, and have hence been almost certain to overlook or to misinterpret isolated cases of it. In the year 1878, however, the attention of Dr. Russell, the medical officer of health for Glasgow, was called to a group of mysterious attacks of disease, attended with a high mortality, which occurred at a factory in that town, among workers in Siberian horse-hair. He ascertained that this mysterious disease was anthrax fever, and concluded that the workmen had contracted it from handling affected horsehair. Two years later the attention of the Local Government Board was directed to the existence at Bradford of a disease frequently fatal, but only imperfectly understood ; and Mr. Spear was directed to inquire into the subject. The following quotation from Dr. Buchanan's Report for the year 1880 summarises the results then arrived at : " Mr. Spear found that, in sequence to a large number of occasional cases, the nature of which had at the time of their occurrence been matter of suspicion, some thirty or forty cases, definable as anthrax, had occurred in eleven months among wool-sorters in Bradford and neighbouring districts, and that no less than twenty deaths had to be ascribed to this cause. The disease, whether it shewed itself more by external or internal symptoms in the persons of the affected wool-sorters, was found by pathological observation to be uniformly characterised by the presence of bacillus anthracis in the blood and organs ; and the material of the disease had been received, it appeared, into the body of the worker, now by the way of the skin, now through the lungs or stomach. Experiments conducted by Dr. Greenfield, in aid of Mr. Spear's inquiry, showed that in all cases where

decomposition did not interfere with the result, the fluids derived from fatal cases of the disease were capable of producing the same disease in mice and guinea-pigs into which those fluids were inoculated. An unintentional experiment on cows and sheep was made by the irrigation of certain fields with the washings of wool from a factory near Keighley, with the result of producing unexpected deaths among the animals pasturing on the fields; their disease having characters similar to those observed in the human subject, particularly in the presence of the same bacillus anthracis in the fluids of the body."

"Not all wools and hairs were found equally capable of producing the disease. The dangerous wools were foreign wools, and the most dangerous of all was a kind of mohair coming from the Van district of Armenia. There appeared reason, moreover, for believing that the infective quality resided more especially in the 'fallen fleeces' of a wool-bale; in that portion, namely, of the wool which had been shorn from dead animals, and which forms about five per cent. of the whole."

In the report of the Local Government Board for 1882 are comprised the results of a further inquiry by Mr. Spear with respect to the occurrence of the same disease among persons engaged in the London hide and skin trades. It would take too long to consider the details of this very interesting report. But it shows conclusively that anthrax fever, in both its forms, is of not infrequent occurrence amongst those concerned in the industries referred to; and that, as might be supposed, the chief sufferers are the persons who have to handle the raw hides coming from abroad, namely, wharf-labourers, sorters' labourers, and tanners' labourers. No evidence of the occurrence of the disease could be traced amongst fellmongers. It is an interesting fact, too, as further proof (if need were) of the nature of the disease amongst the workmen in London, and of its virulence, that in consequence of the removal from a tannery, in which there had been special recent prevalence of anthrax, of refuse for manurial purposes to a farm near

Guildford, a destructive outbreak of anthrax occurred among the farm horses and cattle, just as had occurred previously in connection with the Bradford epidemic. These several inquiries show conclusively that the workmen who have to do with foreign hairs and hides incur a serious risk of contracting anthrax. There can be no doubt that many such attacks have been overlooked up to the present time, and it is satisfactory to know that now at length the danger is generally appreciated, and that precautionary measures against it are generally adopted.

There are still two or three diseases which may, I think be fairly called industrial diseases, to which, before I conclude, I should like to advert: one is the so-called "clergyman's throat," another is the affection known as "writer's cramp," or scrivener's palsy. Clergyman's throat is not limited to members of the clerical profession; but is an affection to which all habitual or professional speakers and singers are liable. It is a form of follicular laryngitis, which is caused by the constant over-exertion of the voice, especially if that over-exertion be continued at times when the patient is suffering from catarrh, and which, if the over-exertion be continued, is apt to become chronic and incurable and to incapacitate the sufferer from his duties. Scrivener's palsy is a peculiar affection to which clerks and persons who have to do much writing are liable. It consists in a kind of momentary loss of power or spasm, which affects the muscles of the thumb and fingers engaged in writing, which in advanced cases involves the muscles of the arm as well, and which either causes the writer to drop his pen, or to make some sudden movement that checks or mars his writing. In a large number of cases the disease is progressive, and finally renders continuous writing wholly impossible. Sometimes its development in one hand has compelled the sufferer to learn to write with the other hand. Unfortunately for him, however, the affection is apt to spread from one side to the other. Scrivener's palsy is only the best-known, and perhaps the commonest, of a

group of spasmodic or paralytic affections to which persons who have acquired skill in the use of particular groups of muscles are liable. The pianist, the swordsman, and others whom it is needless to enumerate, suffer from analogous disorders.

The sketch of industrial diseases which I have given is short and necessarily incomplete. I cannot pretend that I have consulted all the literature on the subject which has accumulated during the last few years; and my personal studies are limited to two or three inquiries which I conducted many years ago for the medical officer of the Privy Council, and to the casual material which has been afforded me by my position as an officer of health and physician to a large hospital. It is probable, therefore, that there are some well-known industrial diseases with which I have no acquaintance; and, with respect to some of those which I have brought under your notice, I cannot speak with any certainty as to what their present prevalence is as compared with their prevalence years ago. Moreover, I have not ventured to enter at any length on the important question of their prevention. I console myself, however, with the consideration that it would have been utterly impossible for me, even if my knowledge of the subject had been profound, to give an adequate account of industrial diseases in the limited time placed at my disposal; and that my paper will be completed and corrected by the observations it will doubtless elicit from those whose knowledge, of at any rate particular parts of the subject, is much more intimate and much more recent than mine.

ON COWS' MILK AS A VEHICLE OF INFECTIOUS AND EPIDEMIC DIS- EASE TO THE COMMUNITY, WITH SUGGESTIONS FOR THE MORE EF- FECTUAL PREVENTION OF SUCH OUTBREAKS.

By W. N. THURSFIELD, M.D.

To fully consider the above subject would involve questions in comparative and human pathology which would of themselves more than occupy the time at my disposal on the present occasion. I shall therefore endeavour to confine my remarks to generally acknowledged facts, moulded as far as possible by personal experience, and to suggest such remedial measures as shall be immediately practicable and equally efficacious and advisable, whatever technical views may be held as to the extent and precise mode in which cows' milk becomes a vehicle of human disease.

The subject is one with reference to which it is specially desirable on the one hand not to create undue alarm, and on the other hand not to make light of or pass over apparent sources of disease, however improbable they may appear at first sight. It is, however, one of growing importance. Milk is daily becoming more recognised as the staple food for children, and from a variety of causes it is, I fear, a fact, that year by year the proportion of women physically incompetent to suckle their offspring is increasing. The use of milk by adults has of late enormously increased, and although I cannot but consider that to drink milk as a beverage with heavy meals is a grave dietetic error, the modern practice of drinking glasses of milk instead of beer at railway refreshment bars and elsewhere is certainly not to be condemned.

The greatest risk of danger from milk lies, however, in the fact that the chief consumers are of an age when the body is most susceptible of taking disease, and the consumption of unboiled milk may literally be said to bring the consumer into close connection with the animal from which the milk was drawn, and, always to some extent and often most intimately, with the family and domestic arrangements of at least one household and often two. That the above inevitable connections may be rendered as free as possible from danger to the milk consumer is the aim I have in view on the present occasion.

When we consider that a considerable proportion of animals yielding milk are in that parturient condition which is specially prone to sickness, and when we also consider to what extent milk is a reflection of the bodily condition of an animal and of its food, and how very absorbent milk is of volatile matters in the atmosphere, equally liable to take up and taste of any peculiar odour, organic or inorganic, as to be affected by putrefactive emanations, and, even in the absence of such, most prone to undergo septic changes, the wonder is not that so many but that so few bad consequences have been hitherto traced to its door.

As cases of infection through milk can only be considered absolutely proved when there is no other condition in common to the sufferers or probable door of infection, the cases adducible as such must as a rule be restricted to epidemics occurring where milk is retailed to a number of families at a distance from the original source of supply and to diseases to which some members of most families are susceptible. It is therefore presumable that in many cases of disease from milk the source has not been suspected, as the evidence has not been sufficiently salient to attract attention.

To Dr. Michael Taylor, of Penrith, is, I believe, due the credit of having in the year 1858 first recorded a milk epidemic in an account of an epidemic of typhoid fever. The subject appears not to have attracted much attention until Dr. Ballard's well-known report of an epidemic of typhoid fever in Islington in the year 1870, since

when records of about a hundred epidemics, alleged to be traceable to milk dissemination, have been published, and others not published have been noted.

The connection of an epidemic with milk supply is a matter with regard to which the statistical method, unless applied with scientific accuracy and rigorous impartiality, may readily lead to a wrong inference and a coincidence be recorded as a consequence, and this would doubtless apply to some of the epidemics recorded. As an instance of how coincidences, presumably most improbable, do occur, I may state the following. A few weeks ago I received a letter from a medical officer of health in one of our largest towns to say that an epidemic of typhoid fever in his district had been clearly traced to a milk retailer who received all his supply from a farm-house in my district, and asking me to be good enough to investigate the matter locally. I immediately visited the farm and found that there was no typhoid at or anywhere about the locality of the farm, and the sanitary arrangements and water supply were satisfactory. I found, however, that the farm in question was infected with foot-and-mouth disease (*Eczema epizootica*), but that the infected animals were carefully isolated and none of their milk sold. The farm happened to be the only one in that part of the country so infected. Whilst I was pondering as to how best to meet the conclusion that I feared some would inevitably come to, viz., that the disease of the cattle had been transferred to human beings in the shape of typhoid fever, I received a second communication from the medical officer of health above referred to, saying further investigation had revealed circumstances on the retailer's premises amply sufficient to account for the epidemic of typhoid.

Making allowance for all doubtful cases, it may, I think, be accepted as an absolute fact that epidemics of typhoid fever and scarlet fever have been repeatedly disseminated by milk, and that there is very strong evidence that diphtheria has been so disseminated, and instances have been adduced by most competent observers. Other infectious diseases have been alleged to have been so transmitted, but

the cases are not so numerous nor the evidence so clear. If, however, we accept the transmission by milk of the diseases above named, we are justified by our knowledge of the nature of infectious diseases generally in assuming that to a certain degree the same danger may exist in the case of all infectious diseases, and should be guarded against.

With a view to propose efficient preventive measures it is necessary to consider the probable mode in which milk becomes a vehicle for the germs of infectious disease. I am certainly expressing my own opinion, and I believe also the opinion of the majority of those who have carefully studied the subject, that this is a point on which we have as yet very little accurate knowledge. In the case of the majority of milk epidemics investigated, typhoid fever has been the disease involved, and in the majority of such cases specifically contaminated water added to the milk has been regarded as the source of the evil. This doubtless has been the case in many instances, but this theory does not appear to satisfactorily explain all the epidemics of typhoid fever, and less so the epidemics where scarlet fever or diphtheria has been the disease involved. Another possible explanation is that the milk may be a simple carrier of the disease in the same way that articles of clothing convey the germs of disease. This may explain some cases. There still however remain a considerable number of epidemics in which the above explanations do not suit the observed facts. Another explanation is that milk itself may become specifically infected and serve as a nidus for the disease germs, in other words, may itself catch the disease. Certainly milk is specially calculated by its composition to act as a cultivation fluid for germs proper to the human body, though it is difficult to believe that it would readily so act at the ordinary temperature. The temperature of healthy milk, taken as soon as practicable after the milk has been drawn from the cow, will be found to be from 99° to 100° F. We have therefore in milk, warm from the cow, a fluid specially suitable in composition and condition to afford a favourable seed-bed for the germs of infectious disease,

supposing them to be capable of cultivation or development outside the human subject. Now, supposing freshly-drawn milk to be brought in contact with such germs, through the medium of either air, water, or an individual infected in person or clothing, it is certain that the milk would not destroy these germs, and it is not unreasonable or discordant with analogy to assume that the milk might favour the development and even multiplication of such germs, and thus attain a more uniformly diffused power of infection than it could do as a mere mechanical carrier of the infection. It is indeed remarkable in what a number of instances the above explanation would accord with the observed facts, and specially it has been recorded in the majority of milk-scarlatina epidemics that the cows had been milked by persons in immediate and close contact with that disease. The advantages of artificial cooling of milk, in improving its keeping properties, are so well known that it is unnecessary to call attention to the above as an additional reason why milk should be refrigerated.

Another suggestion is that milk epidemics may be explained on the hypothesis that the disease is a vicarious expression in the human subject of some apparently different disease in the animal. If this were the case those engaged in investigations into the origin of outbreaks of infectious disease would be expected to find a larger percentage of inexplicable cases (*i.e.* cases where the source of infection was not readily traceable) at farm-houses or cottages where cows were kept. Such is, however, certainly not the case in scarlet fever or typhoid fever. In diphtheria I will not give a positive opinion, and it has struck me that very frequently outbreaks in which the source of infection was not readily traceable, have appeared in connection with a certain class of small farms where a few cows were kept, but this fact, if fact it be, may be explicable by the natural history of diphtheria, as in this disease, essentially a disease of rural districts, structural dampness of habitation is of all defects the one most favourable to severity of infectious sore-throat (too frequently not called diphtheria

unless severe and marked by development of a membrane in the throat), and to the persistent vitality of the infection, and to its recrudescence often at intervals of years ; and the class of houses to which I allude are often imbedded, in damp situations or on a water-logged subsoil, and structurally damp, and in some cases have probably remained with little alteration from the day when they were first erected and the choice of locality chiefly influenced by proximity to water and rich pasturage.

Calves occasionally suffer from a throat affection presenting post-mortem appearances very similar to those found in human diphtheria. Assuming the identity to be something more than apparent, it is obvious that cows milked after temporarily giving suck to such calves could very readily contaminate the milk. I have not been able to obtain any evidence of the coincidence of this disease in calves with human diphtheria in the same locality, and, for technical reasons unnecessary to detail, the practice of only partially milking cows would, in the case of regular milk sellers, be exceptional.

It has more recently been suggested that the infected condition of the milk may result from the animal being itself the subject of the disease, contracted either directly from some case of human infection or remotely and after the infection had previously passed through other animal subjects. We know that in mankind the parturient condition renders a mother peculiarly susceptible to take zymotic disease, and that in such cases salient symptoms of the specific zymotic disease are masked and suppressed, and it has been suggested that something of the same kind may take place in the case of the parturient cow, but that the disease is modified, and instead of being severe, as is generally the case under similar conditions in the human subject, is so slight as not necessarily to attract attention. This theory is supported by experimental evidence. Dr. Klein, by inoculating a cow, recently calved, with the virus of scarlet fever, appears to have succeeded in producing a febrile ailment which proved

transmissible to dogs by inoculation, and produced in them an apparently specific disease. The theory also receives some indirect support from certain exceptional features which are said* to have been observed in the character of the disease in milk-scarlatina, viz., exceptionally mild type of disease and little tendency to spread by personal infection. I have, however, certainly noticed exceptional mildness of attack, and I am disposed to think a diminished tendency to spread, in several epidemics of typhoid fever which had undoubtedly been disseminated by the agency of water. The above theory could not, however, apply to those instances in which the milk has been assumed to have become infected after it has been removed from the dairy farm.

In addition to recognised human diseases, milk may become a vehicle for the transmission of recognised bovine disease to man. That the infection of foot-and-mouth disease (*Eczema epizootica*) can be so transferred there is no manner of doubt. Numerous instances have been recorded. Some nine years ago I published a very distinct case, and could now adduce other instances. When, indeed, we consider how sensitive the secretion of milk is to the general constitutional condition of the animal, and that the first symptoms of illness noticeable in cows is a sudden and marked diminution in the yield of milk, and that even the consumption of milk from over-driven and heated, but healthy animals, has been known to produce severe intestinal disturbance, it is difficult to believe that the milk from a diseased animal can be otherwise than injurious. We are, however, met with very contradictory evidence. I know instances where children have been freely allowed to drink milk some portion of which came from cows suffering from infectious eczema, and without injurious results, and there is abundant evidence of the consumption of the milk of animals suffering from pleuro-pneumonia without any ill effect.

* See report by Dr. Power in the supplement to the twelfth annual Report of the Local Government Board.

No amount of negative evidence can, however, upset positive cases, and we are justified in the conclusion that if there is considerable uncertainty, there is sufficient evidence of risk to render it necessary to take such precautions as are indicated by experience.

It is asserted by some high authorities that bovine tuberculosis is transmissible to man. That a considerable proportion of milch cows are affected with tubercular disease is admitted, but whether the disease be or be not transmissible to the human subject through the milk is a matter difficult to prove, and a point about which there is much controversy, though considerable evidence of probability has been adduced. If such transmission can be satisfactorily proved or even shown to be frequently probable, the question of this disease would then transcend in importance any previously referred to by me. To eliminate or even to recognise every animal infected with tubercular disease in a herd of milch cows would be most difficult, and the question of the prevention of the disease in cattle would involve agricultural considerations of the highest importance. As, for instance, one cannot but think that the very customary practice of rearing store calves upon milk deprived almost entirely of its natural fat must be a powerful predisposing cause of tuberculosis. This question of the possible transmission of bovine tuberculosis to mankind is one which demands thorough investigation. All we can venture to suggest as practicable at present, is that no milk should be sold from cows in a recognised stage of tubercular disease.

It is, however, an acknowledged fact that cows fed in urban cowsheds are much more prone to this disease than those fed in the ordinary way in the country, and if the recent large development of the milk trade from the country has had the disadvantage of prolonging the interval during which milk is kept before being delivered to the consumer, and thus affording more time for septic action, this is more than counterbalanced by the lessened danger of the milk being derived from tuberculous animals.

It does not need any evidence of illness produced,

although such evidence could be adduced, to emphasise the requirement that purulent matter from abscesses or local inflammations of the udder should be carefully excluded from milk intended for human food, and therefore that milk from animals so suffering should not be sold. Nor need I more fully refer to cases of illness which have obviously been caused by milk of cows which had fed on plants possessing irritant properties, and which had been taken up by the milk. Such cases are most exceptional in this country.

There have, however, recently been recorded outbreaks of epidemic sickness traceable to milk which, although presenting features agreeing with no recognised human or bovine disease, have presented sufficient uniform characteristics to entitle them to be considered as belonging to a specific disease. The question is, do these symptoms depend upon some epizootic disease transferred to the human subject (and it would be in accordance with analogy and experiment that an animal disease, when transferred to man, may present symptoms varying in degree and kind from those which it originally presented), or are the symptoms the result of the evolution, under favourable conditions, of a special degree of virulence in septic germs received from without, and not in any way connected with the animal source of the milk? The cases appear to present very close analogy with the so-called pork sickness, and in three somewhat extensive outbreaks of this disease which I have been called upon to investigate (records of which are in possession of the Local Government Board), where the disease has presented sufficiently definite characteristics to entitle it to be considered a specific disease, the balance of evidence has appeared to me to be in favour of the theory that the results were due to the latter cause, and not dependent upon an original diseased condition of the animals. It is, however, noteworthy that in all these three outbreaks the pigs had probably been fed upon dairy refuse.

One notable fact in connection with milk epidemics is

that they have generally occurred in connection with milk purveyors who have been under contract to supply a certain amount of milk daily, to be subsequently retailed. This is possibly open to the explanation that in such cases only can the necessary statistical evidence be forthcoming and attract attention. It is, however, I trust no libel on human nature to say that milk purveyors so situated would have greater inducement to continue the use of milk from cows suffering from slight illness, or to bring into trade use milk from parturient animals earlier than would otherwise be done, and, assuming the animals to be the source of the mischief, the mixed milk of twenty cows would at all times be very much more dangerous than the milk of twenty cows used separately. Although in acute disease the quantity of milk is decreased, the secretion does not generally cease altogether ; and it is an important part of the treatment and essential for the well-being of the animal that it should continue to be regularly milked, and some people would probably honestly believe that if this milk was mixed with a large quantity of wholesome milk, no harm could ensue.

It is a popular belief that if the provisions of the Adulteration of Food Act are actively put in force, and the duties of the public analyst efficiently performed, sufficient protection is afforded against evils traceable to milk supply. Chemical analysis, especially when applied to mixed milk from a number of cows, although indispensable to expose a marked addition of water or abstraction of cream, is valueless as an indicator of infected milk, and, as negative evidence of danger or positive evidence of infection, is as fallacious in the case of milk as it is in the case of water.

There are certain circumstances under which, when the individual members of a community cannot well protect themselves, it is recognised to be the duty of the State to furnish as far as possible the necessary safeguards. This principle as applied to milk has already been endorsed by our legislature, and acted upon in sec. 34 of the Contagious

Diseases (Animals) Act, 1878, and by the Order in Council of July 1879, founded on the above section, and known as the "Dairies, Cowsheds, and Milkshops Order." I propose now to bring under notice the practical working of this legislation with a view of considering what measure of protection is afforded by it to the consumer against the risk that, with milk, the germs of disease may not be introduced into households. I think the answer must be not only that it affords no sufficient protection, but that, in those districts from which disease has been most frequently so imported, the risk is in some respects greater than before such legislation; and the reason I believe to be that this important matter, instead of being placed prominently under the operation of the laws relating to the health of mankind, has been made to occupy a very secondary and subsidiary place amongst the statutes relating to diseases of animals. Nowhere can it be considered a purely local question. In fact, it is almost the widest we have to deal with, as from some of the rural districts for which I act as Medical Officer of Health, quantities of milk are consigned in bulk to Manchester, Liverpool, Birmingham, and London. It is not sufficient that a sanitary authority in London, we will say, should have power, as at present, to regulate its own milkshops, or even interdict any suspected source of supply. There ought, in addition, to be some reasonable assurance that efficient precautions are taken at the source of the milk supply, to which their local precautions can only furnish the necessary supplement.

The public, guided probably by common-sense ideas of the fitness of things, whenever milk has been proved to have conveyed infection from one district to another, invariably appear to blame the sanitary officials of the district from which the disease was imported; whereas, as a matter of fact, the statutory duty of enforcing the necessary measures of isolation in outbreaks of such diseases as scarlatina, diphtheria, or typhoid fever, in dairies, &c., has been so far taken out of the hands of Medical Officers of Health and Sanitary Inspectors, by being made the

subject of special legislation, which places the inspection and control in such matters of dairies, cowsheds, and milkshops in the hands of Inspectors under the Contagious Diseases (Animals) Act.

The local authorities for the administration of the above Act are various, but (with the exception of that part of London under the control of the Metropolitan Board of Works) the whole of England may be broadly divided into districts (boroughs) in which the local authority for the administration of the above Act is necessarily the same body as that which administers the laws relating to human public health, and districts (non-corporate) in which the local authority is the Court of Quarter Sessions, always a distinct body from the sanitary authority. The districts last referred to include nearly all rural districts, and the vast majority of the dairy-farms from which milk is transmitted in bulk for subsequent sale by retail. Speaking from personal experience of considerable portions of seven counties, and from what I have been able to learn of other localities, it is in these districts that more efficient supervision is most desirable, and it is from such districts that infectious disease appears to be most frequently transmitted in the milk-tin. Why is this? Is it because in these districts the local authority is a distinct body from the sanitary authority, or is it for some other reason? I believe the latter, and that the failure is chiefly owing to the fact that the carrying out of the provisions of the Legislature has devolved upon officials who are not to be blamed if they have failed to comprehend the importance of and the method of doing certain things requiring considerable technical knowledge, but for which they have had no technical training whatever.

The executive for carrying out the Contagious Diseases (Animals) Act are, by the provisions of the Act, police officers, who have the power of calling in veterinary inspectors, a machinery doubtless well adapted for the original purpose of the Act, viz., the prevention of the spread of epizootic disease amongst cattle. Local authorities

have power to appoint other and special inspectors, but such appointments are most exceptional.

The statutory provisions which have to be enforced under the above Act by the inspectors are, shortly, that every dairy, &c., shall be provided with proper water supply, and so drained, &c., as to obviate the risk of contamination of the milk by means of sewer emanations or in other ways, and that on the outbreak of any infectious disease amongst the employés, precautions shall be taken to enforce isolation of infected persons from contact with the milk, "until," to quote the words of the Order, "in each case all danger therefrom of the communication of infection to the milk, or of its contamination, shall have ceased." Now with reference to these requirements, every one must admit that if there is anything in the application of trained knowledge to structural works of drainage, or in the application of medical science to the prevention of disease, trained sanitary officials are not only the proper persons, but the only persons to whom such duties should be entrusted. As a rule, the eye only sees what it has been trained to see, and the mind only appreciates what it has learned to appreciate. A police officer, or indeed any officer, however zealous and intelligent, could not be expected without previous training to know if a place where milk was kept was drained with precision; and how could he appreciate the precautions "necessary to ensure the absence of all danger of the communication of infection to milk;" and his opinion as to the wholesomeness or otherwise of a water supply would probably not be more valuable than that of any other non-technically educated person.

To take another very practical point, it is my experience in a large number of epidemics of diphtheria—and the same remarks apply to some extent to scarlet fever and typhoid fever—that the most fertile sources of infection are very slight cases of the disease unattended by a medical man and probably spoken of as merely colds. Now, how can a police officer, or similar individual, be expected to rightly appreciate the occurrence of several cases of sore-throat in

a family during a prevalence of diphtheria, or of the by no means uncommon instances in which scarlet fever is unaccompanied by any rash.

It may be said that by being placed under such jurisdiction as I have described, a dairy does not cease to be an occupied house for the purposes of the Sanitary Acts. This holds good to a certain extent, and is the view which I have practically adopted in my course of action in such districts ; and I have very frequently stopped the sale of milk, using merely the prestige of my office rather than any legal power. But it is nevertheless true that in making any trade or calling the subject of special legislation, the Legislature has indicated to what jurisdiction the calling or building is primarily responsible, and under what Act and by whom proceedings should be taken. And if it became necessary to take proceedings with a view to stop the sale of milk which was presumably infected, the medical officer of health could only do so by calling in the Contagious Diseases (Animals) inspector. In this respect we are even worse off in cases requiring prompt action than before the passing of the Act in question. As an instance, a few years ago, on a milk-seller declining to discontinue the sale of milk which had undoubtedly been exposed to the infection of scarlet fever, I had the milk seized as an article of food that was unsound and unwholesome, and on my evidence to that effect a conviction and fine ensued.

To place all dairies in rural districts under the same regulations as apply to cowsheds in large towns would be an unnecessary interference. Already milk is too difficult to obtain by the cottage class in many rural districts, and every care should be taken not to render this more difficult. A wide distinction should be drawn between milk purveyors and ordinary cow-keepers. The milk purveyors should be alone subject to the special regulations and license. The term purveyors should be restricted to those who sell milk by retail by sending it round from house to house, or keep shops where milk is sold as a prominent article of trade, or transmit milk in bulk to a distance for

subsequent sale by retail. All such purveyors should be subject to licence. Regulations are of course necessary, but what is chiefly needed is efficient inspection and responsible advice under certain exceptional difficulties.

To effectually prevent milk epidemics precautions are necessary :—

- (a) At the house of the consumer.
- (b) At the milk-shop of the retailer.
- (c) At the dairy farm of the wholesale purveyor.

(a) *Precautions advisable at the house of the consumer.*

If there is one fact which more than another has been uniformly brought out in the records of milk epidemics, it is that the consumers of boiled milk have, as a rule, escaped, and the same fact has been noted in outbreaks of an American epizootic which is readily transmissible to man, known as the milk sickness. The same protective influence of boiling infected milk has been observed abroad in connection with the experimental transmission of bovine tuberculosis to other animals. To boil milk may, for practical purposes, be said to confer immunity from infection conveyed by it, though such should never be absolutely relied upon, or when milk is known to be infected. At the present day in this country, milk is the only animal product which is habitually consumed in a raw state. Milk is food and not medicine, and there is no dietetic reason why milk should not be always cooked before consumption ; in fact rather the reverse, and the antiseptic and preservative effects of even partially cooking (scalding) milk are well known. The objection of many on the score of taste would disappear with use, as taste is very much a matter of cultivation. If bread and milk and puddings were the only uses to which milk was applied, there would be no difficulty in recommending that no uncooked milk should be eaten, but boiling milk produces certain physical alterations which interfere with its subsequent general use when cold, and causes considerable prejudice against the obvious pre-

caution of just boiling the milk in bulk when received from the retailer.

The above objections do not apply to cream ; and I am in a position to state, on the authority of an eminent *chef* who has tried the experiment, that there is no culinary mystery in which cream is used for which boiled cream is not as readily applicable as unboiled.

(b) *Precautions advisable in connection with the milk-shop of the retailer.*

Generally those adopted by urban sanitary authorities, with the addition that, on the occurrence of any infectious disease amongst the employés, the fact should immediately be notified to the proper authorities.

An urban sanitary authority should also have the power to stop the sale of milk consigned from any particular farm pending investigations, if satisfied that they have sufficient grounds for so doing, but should be liable for compensation if the step prove to have been uncalled-for or unnecessary.

It should also be incumbent on a retailer of milk, when required by the sanitary authority, to furnish a list of his customers.

It has been suggested that milk retailers should be required to adopt such a system of book-keeping as would enable the farm source of the milk supplied to any particular house to be at once identified. Such a requirement would, I fear, be to some extent impracticable and certainly harassing.

(c) *Precautions advisable at the dairy farm of the wholesale purveyor.*

In connection with the above subject, there is much that is theoretically desirable that is at present not practically attainable ; I believe, however, that it is possible, without omitting any requirements absolutely essential to safety, to

restrict the compulsory provisions to such steps as are practicable under existing conditions. The requirements as to cubical and floor space and ventilation, of the regulations generally adopted in the case of urban cowsheds, are unnecessary in the case of dairy farms, and I fear that in the case of rural cow-houses, requirements as to washable wall surfaces and impervious flooring could not at once be complied with, and the same would apply to the requirements as to daily registering the quantity of milk given by each cow, and taking the animal's temperature, and the restrictions as to feeding, incorporated in the regulations adopted in some parts of Germany.

There are certain requirements, however, which are essential and not unreasonable.

The premises on which the business of a milk-purveyor is carried on should be registered with the local authority.

Every registered dairy should be provided with a plentiful supply of good potable water for the use of the dairy and cows. Dairy-farm proprietors need be under no alarm at this requirement. It is a very different matter from requiring every house unprovided with water on the premises to be furnished with such supply at any cost. It is essential for the conduct of a dairy farm at all that there should be water for cattle and dairy purposes, and the business would not be attempted under other conditions. To require that the water be of good quality should entail no additional trouble. By good potable water I do not mean water coming up to an arbitrary chemical standard, but the uncontaminated water of the district, *i.e.* wholesome water, free from animal or sewage contamination, or excess of organic matter, and, which is most important, so situated as regards its source, and so protected as regards its storage, as not to be liable to pollution by sewage. That the water connected with country houses does not, as a rule, come up to the above requirements is simply because no care has been taken in selecting the spot on which the well is sunk, and no precision used in protecting wells or other reservoirs from obvious sources of contamination. About such

houses there are always spots where it is very undesirable to place a well, although such are generally selected, convenience of access being alone considered; but there will also nearly always be found a choice of situations not open to objection, and where care in protecting from surface infiltration will ensure good water. In short, good water can as readily be obtained as bad.

The dairy used for storing and treating (refrigerating, &c.) the milk should not be subject to animal effluvia of any kind, and should be satisfactorily drained, *i.e.* with no drain end (unless disconnected) inside it, and the dairy should not be used for general domestic purposes.

Under the following circumstances the milk should not be transmitted for sale:—

Milk presenting any marked deviation from ordinary appearances, in either colour, smell, or general condition.

Milk from an animal manifestly the subject of constitutional disease.

Milk from an animal suffering from acute disease or infectious disease of any kind.

Milk from an animal suffering from abscess, inflammation or painful swelling, or other affection of the udder.

Milk from an animal that has not completely recovered from the febrile state and other symptoms incident to parturition.

On the occurrence in an animal of any symptoms of acute disease, or a large and sudden diminution in the yield of milk, the milk should be set aside.

On the occurrence in the person or family of any one employed about the cows or the dairy of any eruptive or infectious disease at all, or of any throat complaint affecting three or more persons, the affected individuals should be isolated, and the fact notified to the health officer.

In most of the above requirements the milk-purveyor would be a gainer, as he would always be in a position to avail himself of responsible advice. Notification of disease need not, for obvious reasons, entail publicity, but in such

cases the responsibility of the necessary isolation would devolve on the medical officer of health.

I believe, indeed, inspections may be so carried out that the inspector would come to be looked upon, not as an interloper only borne with so far as the law demands, but as one in a position, under certain circumstances of disease incidence, to give advice, valuable from a commercial as well as from a sanitary point of view.

Whatever differences of opinion there may be on technical points and matters of detail, I think that all who have carefully considered the subject will have formed a decided opinion that the adoption of regulations as to the sale of milk should be incumbent on local authorities, and not permissive, as at present, and that the regulations should be applied at the producing as well as the distributing depôts.

I am induced to add a few words with reference to butter, not only because the subject of milk cannot be said to have been completely considered without some reference to butter, but chiefly because its consideration furnishes the key-note to the only true and final solution of the whole difficulty, viz., the practical extinction of the infectious fevers in rural districts.

Butter-making is the most profitable branch of dairy industry, and is the one most commonly pursued, especially by those who only keep one or two cows; and for one person who transmits milk from country to town for subsequent sale by retail it is safe to say that one hundred transmit butter, generally through the hands of middlemen, who purchase the butter at the country markets. As a majority of the original vendors of the butter are of the class who do not keep servants, in the event of sickness occurring in the family the mother would be at the same time nurse and butter-maker, and that this is constantly the case I speak from personal experience. In America, the "milk sickness" before alluded to is said to be transmissible from animal to man by means of butter as well as milk, but I am not aware of any evidence in this country

of the transmission of disease through the agency of butter. Such evidence to be satisfactory would be most difficult to obtain, but that butter is constantly made under conditions where it is brought into most undesirable contact with infection is a fact beyond dispute. As I write this I know a house where the mother of a family is nursing two children and her husband, all suffering from diphtheria, and is making butter from three cows; and I specially call to mind another case in which the brave wife of a small farmer on the Welsh border, deserted by her only female domestic, nursed solely for some weeks her husband and a resident farm servant, both suffering from severe attacks of small-pox, and made up and transmitted from a neighbouring railway station some thirty pounds of butter weekly to Birmingham throughout the whole illness. The infection had originally been imported from the neighbourhood of Birmingham, and it is not impossible that it may thus have been returned with interest. To attempt any precise regulations in the case of all houses where butter is made would be impracticable. The only solution is to aim at the total extinction of infectious fevers. If not quite practicable immediately, this is, I believe, very nearly so in rural districts. Endemic fevers should never exist. We may expect isolated outbreaks from direct importation, from recrudescence of old infection germs, and rarely, but occasionally, I think, from evolution; but epidemics should never occur. Local disseminations do occur in rural districts from incaution and indifference in visiting infected houses, or allowing infected children to mingle, or through the agency of milk or laundry work; but I believe it may be stated, with a sufficiently near approach to absolute accuracy to justify a general statement, that epidemics in rural districts are invariably the result of school dissemination. In rural districts teachers are frequently paid partly by the school fees and partly by a share of the Government grant, which depends largely upon the average attendance and too often no excuse for non-attendance of a child through illness is held valid unless a medical certificate is

produced. It is, however, generally through cases so slight as not to have involved medical attendance that dissemination of disease occurs in national schools.

This brings us to the solution of the whole question, viz., the attaching of greater importance to all cases of infectious disease, however mild, and the appreciation of the duty of erring on the safe side in all cases of doubt. In this way only can we look for the practical extinction, at least, of epidemics in rural districts, and in no other way can we so nearly ensure that milk and milk products shall not occasionally be brought into contact with infection.

THE NOTIFICATION OF INFECTIOUS DISEASE: ITS IMPORTANCE AND ITS DIFFICULTIES.

By ALFRED HILL, M.D.

WHETHER Lord Bacon did or did not say that "knowledge is power" matters little, compared with the importance of the truth expressed in the dictum. Without a knowledge of the causes, symptoms, and treatment of a disease, we should possess very little power to alleviate or cure it; but without a knowledge of its existence, none at all.

In order to prevent the spread of disease, and the possibility of one or two cases developing into a widespread and fatal epidemic, a knowledge of the existence of first cases is indispensable. The importance of this knowledge, I presume, will be almost universally admitted. There is only one way of obtaining such knowledge, and that is by

means of notification, the imparting of it or making it known to the proper person or authority.

Leaving out the small section who deny the desirability of notification at all as too insignificant in number to demand attention, there are two classes of those who agree that notification is desirable, who stand in opposition to each other as to the question, On whom should the duty of notifying devolve? This question is one not so much exercising the mind of the general public as that of the members of the medical profession, but it is one upon which, on this account, it is very desirable there should be as nearly as possible unanimity of opinion and action among medical men, as it is with them and them alone that primarily the duty of notification of some kind must rest, and without whose co-operation any notification of a thoroughly efficient kind is impossible. There is a difficulty, however, in obtaining this unanimity; and while one section of the profession fully admits the importance and necessity of notification, and is willing to carry it out, another and, I believe, a smaller and still diminishing one, strenuously resists all attempts to impose the duty upon them, maintaining that it should be imposed solely on the householder or guardian. At first sight there is a certain amount of reasonableness in this view of the case, but even this disappears when its advocates proceed to argue that where notification is in operation it has had the effect of doing harm rather than good. If this is their opinion, instead of declaring that they are in favour of early notification as an abstract proposition, they should, to be logical, declare themselves opposed to it, unless they are prepared to prove that notification by the householder is beneficial, while by medical men it is injurious.

I propose here to consider the alleged objections to compulsory notification by the medical attendant, as it is these which constitute the chief obstacles or difficulties with which notification has to contend.

The first of these is the compulsory character of the duty—the compulsion pure and simple, no objection being made

to the proposal to put compulsion on the householder or guardian, though I fail to see that compulsion as such need be considered more objectionable by a professional than by a non-professional informant. It is, however, said to be derogatory to a medical man's dignity and self-respect to be so compelled. But wherever a duty of great importance to the general welfare has to be performed, the only way to ensure its performance is to make it compulsory ; to make the Act simply permissive would inevitably mean failure from non-compliance on the part of some, where it is essential that compliance should be made by all. It is rather late in the day for medical men to display such extreme sensitiveness on this point, and to treat it as though it were a new principle and practice. They are accustomed to notify under compulsion the deaths of persons whom they have attended ; and although it is true that when this measure was originally proposed it met with similar opposition to that now exhibited to the notification of disease, it became law ; and while it proves a great public advantage, it is found to be in no way detrimental to the interests of the medical man, or hurtful to his *amour propre*. Compulsion again is seen in the laws in respect of registration of medical men, and of their services as scientific witnesses, in respect of the sale of poisons, and more heavily still with regard to the provisions for the practice of vivisection. Under these circumstances it seems difficult to understand why, when another service inseparably connected with professional duty, and inferior to none of the others in importance, is required in the interests of public health, there should be such a violent opposition to its imposition. It seems to me that the dignity of medical men, instead of being injured by the performance of the duty required, would be greatly magnified and enhanced. All law is associated with compulsion, which is as indispensable to control the action of non-medical men as of medical. This is seen in the registration of births, vaccination, education, regulation of hours of labour in mills, manufactories, and other places, service on juries, and

numerous other matters, and it is only because it is impossible to accomplish the object in view by voluntary action that penalties become necessary. It has been urged by one opponent of compulsory notification that the voluntary principle is the true one, that it has been known to succeed, and he does not see why it should not be adopted everywhere. There is a simplicity about this view which renders any serious consideration of it unnecessary.

No one will deny, I presume, the value for various purposes of the certification by the medical man of cases after death, but it is of little use as regards the prevention of disease, because it comes too late ; notification seeks to remedy this defect by giving to the sanitary authority the earliest information possible of the case, by which not only may the best be done for it in the way of removing causes, and rendering assistance in various ways so as probably to prevent a fatal termination, but also to prevent the spread of the disease to other members of the household and to neighbours. The causes of the disease are often not inquired into by the medical attendant, who is apt to regard his duties more as curative than preventive ; it is seldom that he makes a searching examination of a house with the view of discovering sanitary defects, whereas the duty of a medical officer of health is not to meddle in any way with a patient, but to seek for any existing defect in the sanitary arrangements of the dwelling. Let us take a common case ; a member of a family may be suffering from diphtheria or typhoid fever, which the medical attendant may skilfully diagnose and treat, but he may content himself with some general inquiry as to the sanitary condition of the house and its surroundings without making a rigorous investigation ; the cause of the illness may be probably a sink or cellar drain in direct communication with the sewer, or it may be a faulty water-closet, leaky soil pipe, a polluted well or some similar defect, discoverable only by such an investigation as would be made by the medical officer of health. If this exciting cause of the illness be allowed to remain during the illness there is little likelihood that the

patient will recover, but if speedily removed the probabilities of recovery are immensely enhanced, "*causâ sublatâ tollitur effectus.*" So that not only is the recovery of the patient rendered more likely, but the dangers of the spread of the disease are likewise diminished. This illustration will serve to indicate the value of early notification, and one of the directions in which it is calculated to be of advantage.

The objection to voluntary notification is that it is incomplete and, as human nature is constituted, probably ever must be, but unless complete it is useless for the prevention of epidemics ; it is only because of its incompleteness and, therefore, uselessness under the voluntary system, that it is necessary to resort to compulsion. The value of complete notification was well seen in Birmingham during the early days of the present visitation of small-pox. This disease is one which from its rarity and from the dread of it in the minds of the public is more likely to be spontaneously notified than any other ordinary zymotic ; the consequence was that for many months the disease could get no footing in the town, because under the influence of fear every case was notified to me directly on its nature being made out ; over many months 77 sporadic cases were reported, with the result that the disease was prevented spreading by means of isolation, disinfection, &c. ; but in time cases occurred which were not reported, and then the disease, liberated from control, rapidly became epidemic ; as long as every case was reported the epidemic was prevented, but no longer. The voluntary system answered for a time, but soon broke down, as it always will do, and as it always has done from time immemorial to the present. The experiment has been made so long that it is unnecessary to continue it ; it has indeed lasted too long, and to continue it still is altogether unjustifiable. Of the nearly 300 practitioners in Birmingham only 113 have ever voluntarily notified. In saying this much, I don't mean that these 113 have all notified in each year, but only last year. Nor is it to be understood that they have notified all their cases, but only such as

they pleased, and probably only a small proportion ; or that they have notified them early, when alone notification is of much value.

In my Annual Report for 1877 I remark that, "out of upwards of 200 medical practitioners in the borough, only seventeen reported cases of disease during the whole of the year." The diseases notified have been, moreover, principally such as a fee is paid for, viz. scarlet fever and small-pox ; the cases of diphtheria and typhoid reported are comparatively few, while of measles not one in a hundred has been notified.

Does any person believe that such a system of notification can achieve a real advantage in the way of protecting public health, or lead to any result except the waste of public money ?

The voluntary system answers very well in the case of cholera, because so great is the alarm and even horror excited by the disease, that it is practically compulsory, in other words, that result is effected by fear which is denied by reason. But in the case of a disease of which there is no fear, such as scarlet fever, although it is a thousand times more destructive to life, the voluntary system breaks down altogether. Instead of the medical man reporting every case of preventable disease, he reports only such as he chooses ; he will report for instance the case of a domestic servant whose presence in a large and respectable family is considered objectionable, and whose removal is therefore desired, and she is removed to the hospital accordingly, but the next case he may for special but insufficient reasons decline to notify, although the danger to the public may be as great in the one case as in the other.

There is generally no reticence in publishing to the whole world the illnesses of royal or distinguished personages, and in much more detail than is required for the protection of the public health, while in notification of disease to the sanitary authority there is no publication at all ; there is simply intimation accepted in confidence and acted upon with the sole view of benefiting the patient and the com-

munity. Notification to be of real value must not be optional but imperative ; it must not be subordinated to individual interests or caprice, because it is then too uncertain, too partial, and frequently too late. As a fact I frequently receive from the medical man notification of cases of zymotic disease after being attended by him for several weeks, and sometimes after the death of the patient. This is under the voluntary system which obtains in Birmingham, although for such information a fee of five shillings is paid. To expect efficient, that is, complete notification by voluntary means, is to ignore all past experience, and to display a credulity which would discredit an intelligent child.

Another alleged objection to notification by the medical man is that it leads to the concealment of cases, and consequent spread of disease, but the proof of this has never been forthcoming, and the objection rests on mere assumption. Let us hear, on the contrary, what is said by some who have had experience of the actual working of the compulsory clauses, for a little practice is worth much hypothesis, however ingenious. Dr. Butterfield, when Medical Officer of Health of Bradford, wrote : "As to the allegation that people would conceal infectious disease, and not send for medical advice for fear of having the case reported, I can safely say that such has not been the case in this town." The Mayor of Macclesfield says : "Our experience is that compulsory notice does not tend to concealment, but rather the reverse." The Mayor of Oldham gives similar testimony, and the same with other towns ; while in Dundee it was found that there was less concealment of disease after notification was made by the medical attendant than there had been previously when the duty rested with the householder. It thus appears that there is no ground for the assumption of notification leading to concealment, and if there were, it would constitute an argument against notification, whether by the householder or the medical man, and is therefore an argument against notification altogether.

It is further asserted that compulsory powers promote antagonism between the medical practitioners and the medical officer of health. If this be so, I am bound to say that I have failed to find evidence of it worthy of the name; it might be possible by diligent inquiry to discover a solitary case of the kind, but "one swallow does not make a summer," and it has happened more than once that conflict of opinion and antagonism have arisen between even practitioners themselves on other questions than that of notification. For many years in Birmingham there has been voluntary notification, but in no single instance has any antagonism, or even unpleasantness arisen between the medical men and myself. Abundant testimony to the same effect is afforded in towns where the notification is compulsory; thus at Leicester, Alderman Windley stated that "all fear of collision between the medical officer of health and the profession had died out, and the certificates were sent in without difficulty"; at Bradford Dr. Butterfield reports: "I know of no medical man who is opposed to the working of the Act." The Mayor of Oldham states that "there has been no unpleasantness with the medical profession in putting the clauses into effect; they have as a body willingly co-operated with the medical officer of health"; and from Llandudno we hear that "to the credit of *all* our medical men, they work most harmoniously with the Board." After the unvarying testimony of such a cloud of witnesses there seems to be no ground for alleging antagonism, with which it would seem that opposition has possibly been confounded.

If such antagonism were found to exist between the medical profession and the medical officer of health, "'twere a grievous fault," and it would be necessary to discover the causes of it, and remove them, because no good is to be expected without the cordial co-operation of the medical profession with the sanitary authority.

It has been alleged that the conduct of the medical officer of health is likely to be inquisitorial, and that he

may interfere with the patient, and otherwise take advantage of his opportunities to annoy and injure the practitioner. This contingency is so remote and improbable that it is scarcely worthy of serious discussion. No medical officer of health properly qualified for his duties could act in such a manner; to suppose otherwise would be to assume that, the moment a medical practitioner becomes a medical officer of health, he forgets professional obligations, and loses the instincts of a gentleman, which is not only absurd, but opposed to experience.

There have been doleful predictions that notification by medical men would be a betrayal and destruction of that confidence which is necessary between doctor and patient; such would no doubt be the case in some instances if there were no compulsory law requiring it; if the secrets of the sick room were published, instead of the case being simply notified; if the object were to injure instead of benefit the patient and the community, and if all medical men were not placed under the same necessity to notify; when, further, it is the rule for the householder, as well as the doctor, to notify, the former can have no possible ground of complaint in this direction. Here is seen one of the advantages of the dual system. It was attempted by Mr. Hart in his "model clause" to meet this question of betrayal of confidence, and at the same time the objection of medical men to be put under a penalty, and in order to do this he proposed that compulsory notification should be put upon the householder, to whom the medical attendant must furnish a certificate, which the householder is bound by penalty to forward to the sanitary authority; while no penalty falls upon the medical attendant in the event of his refusal to certify. The weak point of this clause is that it is impossible to obtain the co-operation of all medical men without the imposition of a penalty, so that this objectionable regulation is really rendered necessary by the fault of the medical profession itself, which, therefore, cannot reasonably complain: "*salus populi suprema est lex.*"

It is a remarkable fact that out of thirty-eight towns in

Great Britain which have availed themselves of compulsory notification, thirty-four have adopted the system of direct notification by the medical attendant, while thirty of these require notification also by the occupier ; in three of them only does it rest with the medical man to notify indirectly or to the occupier, so that the dual system is found to be by far the most in favour ; it is the one recommended by the Local Government Board in 1878, and by the Select Committee of the House of Commons in 1882 ; it is theoretically the only efficient one, and in practice it has been proved to work satisfactorily. It is the system embodied by Mr. Hastings in his Bill of 1883, and it is, I believe, the one which commends itself to all impartial minds, and to all persons of experience.

The reasons why the medical man should notify appear to be so plain : he alone is qualified to diagnose the disease ; he alone, bearing in mind the ignorance, poverty, and other disqualifications of large numbers of persons, is qualified by his education, his appreciation of the necessities of the case, his freedom from interest, prejudice, alarm, or confusion, to notify it, and he would by his direct action save much unnecessary delay.

As a fact, where notification is carried out it is nearly always by the medical man, even under the dual system.

The householder, on the other hand, is disqualified to report with promptitude and certainty by a number of circumstances, partly for reasons already stated, and also for some others, as want of time and opportunity. One insuperable obstacle would be created by the impossibility of supplying every householder with notification forms, and if that difficulty could be surmounted the forms would soon be lost. It is desirable, nevertheless, to hold the householder responsible to meet cases where a medical man is not called in.

In one town only has notification by the householder been tried, viz., Greenock, and, as might be expected, the results are very unsatisfactory, as only something over 50 per cent. of the cases came to the knowledge of the sanitary

authority ; but even under these circumstances the death-rate of the town diminished progressively and considerably ; it is therefore clear that with a more complete system a proportionately greater advantage would have been gained. Dr. Wallace, Medical Officer of Health of Greenock, concludes a very valuable and interesting report by expressing a fear "that no further material improvement will take place from notification by the householder." He is forced to the conclusion that the only satisfactory method of notifying infectious disease would be to throw the responsibility on the medical practitioner, as well as on the householder ; in other words, the dual method.

It has been urged as an objection against notification—and this objection holds good in the case of the householder—as well as of the medical attendant that it would be injurious to business. This is possible to a certain extent, but my experience shows that it is a great advantage, by removing real danger, and so permitting the business to be carried on with safety. In several instances I have had employés in large establishments removed to hospital, to the advantage of the patient and to the great relief and protection of the other inmates and the public ; the proprietors have been shrewd enough to discover the advantage and grateful for the assistance rendered. In such cases, of course, removal is carried out as quietly as possible, measures of disinfection and precaution are judiciously conducted, and no publicity results. But even should there be publicity, and the business suffer in consequence, either through customers avoiding the shop or the latter being temporarily closed, surely this is a smaller evil than the disease being allowed to remain unreported, and left to spread itself broadcast.

Circumstances have come to my personal knowledge which clearly prove the necessity of the sanitary conditions of lodging-houses being known. A short time ago two Birmingham artists who had been to Jersey for a few weeks returned home suffering from typhoid, and one of them died ; the disease was traced to their

lodgings. Such cases are quite common ; people leave home to recuperate their exhausted energies at a maritime or other health resort, and in some lodging-house or hotel contract a dangerous, often fatal, illness. Notification would prevent such horrible catastrophes, and I am fully convinced that the hotels and lodging-house keepers would be benefited, instead of prejudiced, by the arrangement. If they were alive to their real interests, they would court examination and certification of the sanitary condition of their establishments rather than attempt concealment of defects and dangers ; indeed, some hotel-keepers do actually have their hotels systematically examined and certified by a competent person, and such a course cannot fail to inspire confidence in their guests.

Milk-shops and schools are particularly liable to prove centres of preventable sickness and death, unless cases of illness in them are at once notified. It is wonderful to find any one prepared to contend that the proprietors of trade or other establishments should be protected at the expense of the whole community, and it implies a singular excess of innocent belief in the perfection of human nature to expect them in all cases to give notice of the danger in their midst, when at the same time they believe that their interests will be thereby prejudiced.

The absence of adequate and suitable hospital accommodation has been cited as an argument against notification. The objection has, however, much less force than at first sight it appears to have. Very much can be done without a hospital, though I am far from supposing that hospitals are not necessary and indispensable. There is, however, very generally a backwardness on the part of the sanitary authorities to provide them on account of the expense, and some powerful influence is required to put them in motion. It is a fact proved by experience that nothing conduces so much to this result as notification. The daily receipt from medical men of reports of zymotic cases that require isolation, which is not being obtained at home, inevitably leads to the provision of hospital accommodation, which other-

wise would have been neglected, so that the absence of hospitals actually becomes an argument for, instead of against, notification.

On the other hand, the existence of hospitals, and of sanitary organisation, costly as they are, are comparatively useless without notification ; and, indeed, without it the provisions of the Public Health Act, particularly those included in sections 120-143, are a dead letter.

The absence of notification, full and complete, has a relation to the extent and cost of hospital accommodation, which is worthy of notice. For instance, supposing every case of disease be reported as soon as made out, the first cases would receive proper attention and isolation, the disease would be nipped in the bud, and a very small hospital would suffice ; but if, on the other hand, first cases are not reported, the stamping out process fails, the disease rapidly extends and becomes epidemic, and then the most gigantic hospital fails to meet its demands. This relation between notification and cost of hospital accommodation, without regard to other considerations, seems to me a matter of the greatest importance ; and the fact should not be lost sight of that the main value of a hospital for infectious diseases is to treat first cases and prevent epidemics, and not to treat thousands of cases which might, with proper care, have been prevented.

In conclusion, I would point out how little can be said against notification, that what is urged against it is, for the most part, of a hypothetical and speculative character, and that its principal opponents are persons who have had no actual experience of its working. On the other hand, both the public and the medical profession, in those thirty-eight towns where it has already been submitted to a practical test, accept it with satisfaction. Would they do this if it proved on trial as objectionable as it was predicted ? Why, in these very towns medical practitioners who were at first bitterly opposed to the plan have, on seeing the results of its operation, ceased their opposition, and have become its most loyal and valuable supporters.

I trust the medical profession is being gradually educated up to a proper appreciation of its value, and to a becoming sense of their duties with regard to it. It would be a subject of the profoundest regret to find them in prolonged antagonism to a measure which is necessary to the public good, as has already been abundantly proved.

Such opposition can only be based on mistaken views with regard to the influence of notification on public health, on strictly professional interests, or on sentiment. It is clear that the first is benefited by it ; it would be difficult to show that the second would be in any way prejudiced ; and the third ground requires no serious consideration. The medical profession is, I am sure, too noble and too generous in its aims to let mere sentimental objections or considerations of self-interest, or a false professional *amour propre*, stand in the way of the public weal. We are the servants, and not the masters of the public, and it has been usual to regard our profession as the most philanthropic, benevolent, and self-sacrificing of all ; but I fear that a continuance in opposition to a great sanitary step forward is calculated to jeopardise its reputation, and not the less so because, while a section of the profession is hanging back, the practical common-sense and prudence of the nation at large, as shown by the action of a considerable number of towns already, will step in and do the work without its assistance.

THE DISPOSAL OF THE DEAD.

By A. WYNTER BLYTH, F.C.S.

§ 1. The term "disposal of the dead," in its popular narrow limitation, means simply the disposal of human remains, but, taken in its widest significance, includes the disposal of everything which has had life, whether vegetable, animal, or human, for, as it has been finely sung,

"O Death! thy mark is on the flower and on the tree,
And on the beast, and on the bird,
Thy shade is on the mountains, even the sea
By thy sad foot is stirred.

Slayer thou art of all my soul deems fair,
Thou saddenest the sun ;
Of all things in the earth and sea,
O Death, thou sparest none."

In this essay I must confine myself to the methods of dealing with human remains, those actually followed in civilised and uncivilised nations at the present time being pretty much as follows :—

§ 2.—1. Simple exposure, so that, according to the climate, the body is wasted by the slow influence of the elements, or is consumed by insects, birds, or carrion-feeding animals.

2. Burial in the ground in all its varieties.
3. Burial in the sea.
4. Burial in fire, *i.e.*, fire-burial or cremation.
5. Embalming, under which head may be included all kinds and methods of preservation.

§ 3. All the varied methods of disposal of the dead adopted by man are carried out by Nature. Dead leaves, worms, insects, and animals, are covered up by dust, sand, and river drift—*Nature's burial*. In the Arctic regions, animal matters encased in ice are preserved indefinitely.

and the fauna of prehistoric ages presented to our view unchanged—here see *Nature's embalmment*. Myriads of dead forms, both from the land and water, find their last resting-place in the ocean—*Nature's deep-sea burial*. It must, however, be confessed that the most favoured of all methods of disposal by Nature is that of the consumption of a dead being by one that is living—the burial of the dead in the quick.*

§ 4. Before entering into a methodical consideration of the disposal of the dead, it will be profitable to sketch briefly the changes taking place during the decay of organic substances.

When such matters are neither desiccated nor frozen, nor eaten nor burnt, but exposed to air and moisture, they are rapidly attacked by living bodies of extreme minuteness called bacteria. The bacteria of putrefaction penetrate into the tissues, divide and multiply, and resolve their elements into simple chemical combinations; therefore, during the whole period of putrefaction, foetid odours, foul liquids, and gases are produced. These phenomena are often compared to the phenomena accompanying slow combustion, but, as Liebig pointed out, if looked at simply from a chemical standpoint, the process is rather analogous to that of a slow distillation.

After series on series of chemical metempsychoses, all matters volatile and fixed are resolved by progressive degradation into carbonic acid gas, water, ammonia, and salts, but the process is so slow, so incomplete, that fossil

* Prince Siddârtha marked—

“ How lizard fed on ant, and snake on him,
And kite on both, and how the fish-hawk robbed
The fish-tiger of that which it had seized.
The shrike chasing the bulbul, which did chase
The jewelled butterflies, till everywhere
Each slew a slayer, and in turn was slain.
Life living upon death. So the fair show
Veiled one vast, savage, grim conspiracy
Of mutual murder, frem the worm to the man,
Who himself kills his fellow.”

human bones from the flint age still contain some unconsumed organic remnant of the ancient body.

§ 5. In certain spots devoid of putrefactive germs, in complete immersion in water, and in places where the air does not have free access, putrefactive decomposition does not take place, but is supplanted by other peculiar processes, such, for example, as those which have been named *mummification* and *saponification*. These changes and the conditions favouring them are but ill understood.

EXPOSURE OF THE DEAD.

§ 6. Simple exposure of the dead, either in special places like the Parsees' towers of silence, or desertion of the corpse, only exists among a few races and tribes. In the rainless regions of the earth, in which the hot sun and dry air prevent active decomposition, exposure is destitute of the loathsome character which it would possess in other climes. If traced back, the entire abandonment of the dead will, without doubt, be found to have a basis upon fear, superstition, or a form of belief. An instance of the latter is afforded by the simple custom of the Chatham islanders ; they place their kin in a canoe, and between the cold stiff fingers lay a baited hook and line. The boat with its silent burden is sent solemnly adrift on the great ocean, to float to some far-off isle of Avalon ; there the fisherman will again rise and ply his craft.

These customs, however interesting, must not detain us ; for they are for our present purpose more curious than useful.

We will, therefore, at once pass on to the various forms of earth burial.

EARTH BURIAL.

§ 7. The origin of earth burial has been confidently ascribed to sanitary precaution ; but, so far as I can see, the

study of the habits and methods of thought of primitive man by no means countenances this view.

In the dawn of intellect, man is perpetually struggling with the forces of Nature—with heat, with cold, with winds, storms, and lightnings ; these become in time to him incarnate, so that he moves among a multitude of mighty and powerful shades. Having once grasped the idea of invisible powers, ready to work weal or woe, the concept of ghost, spirit, or wraith is the natural sequence ; he buries his kinsman, not because carrion taints the air, but because he fears the dead man's double. None have conceived these ideas with greater realisation than the Chinese ; they use no cemeteries, but bury with great solicitude in any spot in which they think the deceased will rest in peace. Should they not succeed in giving this repose, the shade will make all their pursuits unfortunate and unlucky ; hence they often exhume and re-inter if things are not prosperous.

§ 8. The custom of burial remains ; the beliefs under which it was first practised are extinct. We may surround burial with whatever impressive religious ceremonies we like ; but, considered in itself, burial in the earth is no religious rite, nor does its adoption imply any special belief or cult.

Within a time so recent as to be within the memory of men but little past their prime, Commissioners appointed to investigate intramural burial, revealed sickening and disgraceful abuses relative to the disposal of the dead, and led to enactments which have had a most beneficial effect in preventing interment in the crowded graveyards of large cities. Some of the graveyards were owned by obscure and solitary owners, whose direct interest lay in burying as many as possible. For example, the Spafields burial-ground, in extent just about one acre, was originally a tea-garden, but the speculation having failed, it was turned into an unconsecrated burial-ground, and in fifty years the proprietor had received fees for the burial of 80,000 bodies. The evidence in this and similar cases showed that directly the ground was full, room was made for other bodies by breaking up and burning the coffins, and often partially cremating

the remains ; I append in a foot-note * the evidence of a gravedigger, as reported in the *Times*, March 5, 1845. Fortunately these matters are historical, and not likely to be repeated.

§ 9. The ordinary method of inhumation in this country is to leave the body exposed more or less to the air for a few days in a room or mortuary, to enclose it in a wooden box—this, among the rich, in a leaden shell—and then to bury in the ground. If we trace now the changes that occur we find that during the period intervening between death and burial, the little invisible clouds of bacteria always

* The evidence of Reuben Boom, a gravedigger at Spafields :—
“I was in the employ of Mr. F. Green as gravedigger in 1837, and continued in his employ for about fourteen years. Our mode of working the ground was not commencing at one end and working to the other, but digging wherever it was ordered, totally regardless whether the ground was full or not ; for instance, to dig a grave seven feet deep at a particular spot, I have often disturbed and mutilated seven or eight bodies ; that is, I have severed heads, arms, legs, or whatever came in my way, with a crowbar, pickaxe, chopper, and saw. Of the bodies some were quite fresh, and some decomposed. I have had as much as $1\frac{1}{2}$ cwt. of human flesh on what we term the ‘beef board’ at the foot of the grave at one time. I have often put a rope round the neck of the corpse to drag it out of the coffin, fastening one end of the rope to a tombstone so as to keep the corpse upright to get at the coffin from underneath, to make room for the flesh of other bodies. The coffins were taken away and burnt with pieces of decomposed flesh adhering thereto. I have taken up half a ton of wood out of one grave, because I had to take up two tiers of coffins, some of which were quite fresh, and we used to cut them up for struts, used for shoring up the graves. We had as many as fifty or sixty sides of coffins always in use to keep the ground from falling in when digging. We have buried as many as forty-five bodies in one day, besides stillborns. I and Tom Smith kept an account one year ; we buried 2,017 bodies, besides stillborns, which are generally inclosed in deal coffins. We have taken them up when they have been in the ground only two days, and used them to light fires with. I have been up to my knees in human flesh by jumping on the bodies, so as to cram them in the least possible space at the bottom of the graves, in which fresh bodies were afterwards placed. We covered over the flesh at the bottom by a small layer of mould. I have ruptured myself in dragging a heavy corpse out of a coffin. It was a very heavy one. It slipped from my hold lifting it by the shoulders. The corpse was quite fresh. These occurrences took place every day.”

floating about in the air, gain access to the tissues and organs, and according to temperature and other circumstances divide and multiply, and set up those changes which I have already detailed as belonging to the phenomena of putrefaction.

After death from infectious fevers, added to the ordinary emanations of putrefaction, there are those of an extremely dangerous character. The corpse after death from small-pox, typhus, and plague, has been known to be terribly infectious ; and to a less extent after death from measles, scarlet fever, typhoid fever, and pneumonia. The infection may be conveyed by currents of air, or by actual contact with the body, or by the common household fly, or by domestic animals. Since it is improbable that the infectious material continues to be produced after life ceases, the infection in these cases must be that clinging to the corpse, which has been manufactured in the course of the malady.

§ 10. In the houses of those classes which can afford to occupy a whole house, the body can be placed in a room by itself, and during the short interval preceding burial any offence to the senses or injury to health may be but transitory and under control. But among the poorer classes of great towns, especially among those who have to eat, sleep, live, multiply, and die in single rooms, the disposal of the dead presents a problem of considerable moment to the public health. If the poor would immediately consent to the removal of the corpse to a mortuary, there would be little difficulty ; but, naturally enough, the widow is loth to part with her dead husband, the mother with her child ; and very unpleasant and distressing incidents result from this conserving of the body in living-rooms.

The usual course is to lay the body on the single bed, the family sleeping on the floor. I have seen myself the corpse of the mother of a family retained in a room for several days, the widower and five children eating their meals and sleeping in the same room. Not very long ago a person died of an infectious fever in the Middlesex Hospital, the relatives claimed the body, and actually conveyed

it to a living-room situated in my district. There it lay for many days unknown to the sanitary authorities, with the result that three others were struck down with the same disease. There is no London district in which instances of a similar kind do not occur.

§ 11. The presence of various races in cities, whenever they form little groups or colonies, has more than a local influence on the public health. For example, the Italians, French, and Irish in London collect together and import any customs peculiar to their race or religion.

The last rites either of the Greek or the Roman Church, with its impressive ceremonial, the burning of tapers round the corpse, the drapery, the watching, and the praying, imported in even a modified form into the crowded houses of the poor, and considered solely from an hygienist's point of view, is more dangerous than the simpler rites of the Protestant, the Jew, or the Agnostic. We have most experience of the poorer Irish, in whom respect for their dead amounts to a passion. Whatever the deceased has died of, whether a virulent infectious fever or not, there is a gathering of kinsmen and friends ; the wake must be held. As for removal of the remains to a mortuary, such a step is in nearly every instance baffled as long as possible, sometimes even resisted by force. There is no medical man whose duty leads him into quarters tenanted by the Irish but who has occasionally found a room infected by fatal typhus, literally crammed with men and women, solemnising the occasion in their wild way ; in all epidemics of typhus this custom has been one of the circumstances which has favoured its incidence and extension. The ravages of typhus among the Keltic races are not due to any individual susceptibility, but to the retention of old customs and to personal habits which specially facilitate the communication of infection.

§ 12. Another important practical aspect of the question is the ordinary inhumation of stillborn children. The bodies of these are often consigned to the undertaker, and naturally enough, without the form, publicity, and ceremony

attending the removal of the remains of one who had existed a sufficient time to receive a name and to form household ties. The obscurity of these little nameless ones, and the indifference that is shown to their disposal, render possible the loathsome and secret practices which are from time to time disclosed ; I of course mean the conversion of an undertaker's premises into a catacomb for the concealment of infants' bodies.

§ 13. The influence of graveyards or cemeteries on health naturally depends upon their proximity to dwellings, and above all upon their richness in remains actively decomposing. Around the old burial-grounds of London, when abuses were at their maximum, Mr. Ed. Chadwick's able and exhaustive reports* collected a number of facts, showing that the general rate of sickness was higher around the graveyards than elsewhere, and diseases, such as typhus, cholera, and erysipelas, if they broke out, were especially fatal in such spots.

Both modern and past research has shown that the earth of burial-grounds is permeated by the gases of decomposition to a far greater extent than ordinary earth ; and what is called the "ground air" enters into houses in large quantities, being aspirated by the columns of heated lighter air raised by the warmth of our household hearths ; hence an impure ground air almost necessarily produces an impure house air.

The chief gases are carbonic acid gas and marsh gas. One of the more exact recent researches on the amount of carbonic acid gas is that by Dr. Hesse.† In an elaborate research on various graveyards, his chief conclusions are— That the ground air of churchyards is, almost without exception, richer in carbonic acid gas than the ground air of other places.

* 'A Supplementary Report on the Results of a Special Inquiry into the Practice of Interment in Towns.' By Edwin Chadwick, London, 1843.

† 'Ueber den Köhlensäuregehalt der Gräberluft,' von Dr. W. Hesse Archiv für Hygiene. Erster Band, 4. Heft. München und Leipzig.

That the richness of the ground air depends upon the decomposition of the bodies, and is intimately connected with the penetrability of the coffin and the looseness of the graveyard soil.

That the content of carbonic acid gas commences to increase from the moment of burying; in from two weeks to three months it reaches its maximum; it then begins to decrease—the rate of diminution is slower than that of increase. The minimum amount of carbonic acid is reached, at the latest, in from ten to twenty years.

I know of no recent experiments as to the organic impurities of the ground air of graveyards, but we may from analogy conclude that it will be more germ-rich than ordinary air.

Springs in the neighbourhood of churchyards have been noticed to be unusually charged with carbonic acid gas, and occasionally to be contaminated without any obvious cause, save from the proximity of human remains. For the most part, however, the evidence as to the pollution of water is of a conflicting character. Some years ago I examined a number of springs in the neighbourhood of churchyards in Devonshire, but they none of them showed any difference in composition from the other springs of the district. The power of the earth to assimilate and retain organic matters of the kind is so considerable, that contamination of water will only take place under exceptional circumstances.

A RATIONAL PROCESS OF BURIAL.

§ 14. If we continue to bury our dead, the best process to my mind would be to begin on a new plan entirely; to bury only one body in a grave at a minimum depth of six feet; to abolish the use of vaults; to allow no irremovable headstones or monuments over graves; and

to cause at the end of a certain number of years reversion to agricultural purposes.

The general details of this, what I venture to call the rational system, is as follows :—

First as to the space required.

In calculations as to the space required, we must allow for spaces between each grave, to avoid the uncovering of the coffin in one grave in opening another, and accident from collapse of the sides of the graves, and also must allow for paths or walks.

The average dimensions of an adult coffin are six feet three inches by one foot nine inches, so that 3887 coffins could be packed side by side in an acre of ground ; but the proper space to give to each adult coffin, which will allow for walks, &c., may be put at forty-eight square feet, for children between five and fifteen, twenty-four square feet, and for children under five, twenty square feet.

In the year 1882, there died in London 82,913 people ; of these 36,286 were infants under five, 4126 were under fifteen, and 42,501 were adults. The amount of burying space that they would require, supposing each body occupied one grave, and one only, would be as follows :—

	Square feet.
36,286 × 20 =	725,720
4,126 × 24 =	99,024
42,501 × 48 =	<u>2,040,048</u>
	2,864,792

Or very nearly sixty-six acres ; allowing for increase of population, seventy acres of ground would receive decently all the London dead for 1884.

Taking London as an example, plots of a hundred or more acres would be selected north, south, east, and west of the Metropolis, drained and prepared. Great granite blocks as boundaries would be placed along the four sides of the area, and from these fixed points, lines would be drawn mapping out, and dividing the whole area into

latitudes and longitudes, so to speak. By these simple means the position of a grave could be determined at any distance of time.

Temporary crosses might be permitted, but no headstones or monuments. The departed may be commemorated by cenotaph, by the adornment of public buildings, the erection of works of art. All of these modes of commemoration are more lasting than those usually adopted.

At the end of five years from the last burial, the ground in any plot would be cultivated but not built upon. Some might be turned into plantations, some into pasture or arable land. In either case, beneath the waving corn, or the stately pines, the remains would be free from desecration ; their exact site could be determined, by the aid of the permanent boundaries, with mathematical certainty ; the earth would not be robbed of fertilising material, and the acres and acres of cemetery ground which is now being continually withdrawn from its office as a food producer would be utilised. The areas would remain for many years as open spaces ; but should a quarter of a century elapse since the last burial, and some urgent public necessity arise for conversion of such an area to other than agricultural uses, then I see no objection to such conversion, provided due notice be given of the fact, and relatives be permitted to remove the remains of their ancestors should they choose to do so. Nor do I see any reason why, after a sufficiently long period, such an area could not be again, if necessary, converted into a burial-ground.

Few people, save those who have examined into the subject fully, realise the extent to which nearly every old burial-ground has been disturbed. I have seen gravestones built into the walls of dwellings, and cottage floors paved with them.* At Shebbear, in North Devon, in the repair

* “ Sepulchral stones of the seventeenth century are rare, for the utilitarian churchwardens of a former generation sent a large number to Newcastle to be turned into grindstones, and in 1796 they disposed of a further quantity for £38, and obtained 2s. 6d. for a stone figure.” — (“ St. Nicholas’ Church, Yarmouth ”). ‘ Perlustration of Great Yarmouth.’ By Charles John Palmer.

of the church many years ago, a very large number of human remains were heaped up outside the door of the village inn. After a time some of the bones were carted away by a farmer, and he manured his fields with them ; but most of the heap still remains, and when Medical Officer of Health in that part I carefully examined it, and ascertained the truth of the story.

The history of burying-places plainly shows that, what with the gravedigger and the alteration and enlargement of churches, no corpse is safely or permanently placed in the old yards ; and if this is true of the old, it will also hold good with the new. There must come a time when the great cemeteries will be permanently closed, when the monuments and stones will be neglected and decay, and then the ground will revert to other uses. My proposal is an anticipation of this, the reversion being sooner, and the method of burial, I believe, more sanitary and rational. The proposal will, no doubt, to those to whom every reform relative to interment is looked upon with disfavour, be characterised as a scheme to raise cabbages and turnips from our defunct relatives. Some will oppose any suggestion favouring the use of what they would call unconsecrated ground ; and, lastly, there is the objection to be met that, in course of time, there would be no rood of ground in the island which had not received a body.

§ 15. The transformation of the offensive products of decay into the vegetable world is the natural metamorphosis which is going on for ever and for ever, the building up of the fabric of life from the quarry of death. It is impossible to say whether the nitrogen, the carbon, the phosphates in the bread we eat, have ever formed an integral part of our ancestor or not. The grass, the flowers, and the corn, raise their slender stalks pure and unsullied from the soil, most of which has in some form or other itself lived. If, indeed, we are to be so sensitive in our food as to trace its origin to the corruption from whence it derives so many qualities, and to reject all foods which have been fertilised with what we might regard repulsive and offensive matters, there

would be little left to eat. With regard to the objection to burial in unconsecrated ground, it surely is irreligious to regard any ground whatever as unconsecrated. To me it is all consecrated, and I refuse to believe any ceremonial sanctifies a piece of ground in a higher degree than the sanctification it receives when a good man's bones are there interred.

Lastly, with regard to the gradual conversion of the whole island into a burying-ground. There are about 18,500,000 acres in England which, mainly consisting of meadows and pasture land, may be considered more or less available for burial ; taking as the basis the former calculations, viz., 66 acres for 83,000 interments, it follows that in round numbers 19,340 millions could on such an area be buried, each in separate graves, and that at the rate of 600,000 deaths annually it would take 30,000 years before necessarily the old graves would be re-opened and again utilised.*

§ 16. Other minor reformed systems of burial have been suggested. Thus it has been proposed to bury in charcoal, that is, to encase the corpse in this material. Experiments have shown decomposition goes on in the presence of charcoal almost without odour, and the proposal is sensible and scientific. Persons dying of virulent fevers are sometimes buried in quicklime ; such a method has the advantage of absorbing both the liquid and most of the gaseous products of decay ; it is also popularly supposed to destroy the body, but if examined its action is only superficial, the continued evolution of carbonic acid gas soon turning the lime into the inert carbonate. Burial by encasing the coffined body in disinfectants, or the placing a deep layer of dry carbolic acid powder, or Sanitas powder over the coffin in the grave itself, are all attempts to make earth burial inoffensive to the living, and should be encouraged.

* The total amount of land in England required to start the scheme would be a quantity sufficient for five years, viz., about 2400 acres (or say 2500 acres) ; after the five years a fifth of the original land taken would be yearly reverting to the agriculturist, and a fresh fifth, or a little more, according to increase of population, brought under burial.

§ 17. Mr. Seymour Haden has advocated with great force inhumation without coffins ; he would have the earth in direct contact with the corpse. There is no doubt whatever that if the burying-places possess a suitable soil, or if where the soil is unsuitable the ground be "made," such a method is generally far preferable to "coffined" interments. A fine granular mould rich in carbon has extraordinary anti-septic properties, and if the grave be dug sufficiently deep, the corpse will not be preyed upon by the grosser forms of life. On the other hand, after death from infectious diseases, a coffin gives an opportunity of encasing the body with disinfectants and facilitates its removal, and in such instances the disuse of a coffin might not be free from danger. Mr. Haden's plan might also be found inapplicable to certain clayey grounds at present used as burying-places ; such soils are apt to crack in dry weather, and are only in a small degree antiseptic.

DEEP-SEA BURIAL.

§ 18. A great naval and maritime power, an insular position, the coast accessible from the most central parts of the country by rail, all afford considerable facilities for the disposal of the dead by sinking them to the depths of the ocean. As it is, a vast number of seamen and passengers each year receive, either as the result of fatal maladies at sea or of shipwreck, ocean burial, and it has been proposed to supplant inhumation by submersion. The advantages claimed are : that the dead would be removed completely from the living ; that in the stillness of the great deep no desecration is possible ; and that the departure of the ship with its melancholy freight, the consignment of its burden with fitting ceremony to the last resting-place, would be not destitute of solemnity, and such a method would be peculiarly suitable to a sea-loving nation.

On the other hand, there are fatal objections ; imagine over 800,000 corpses carried out yearly from our ports, the transit by rail, the delays in the stormy periods of the year

from stress of weather, the liability to shipwreck, and the absolute necessity for the vessels to go far out to sea, for public opinion would never tolerate the deposition of the bodies in the channel, or any comparatively shallow water near the shore, but they must be conveyed to parts of the ocean so deep as to preclude the possibility of the attacks of fish ; and besides which the objection urged against cremation, viz., that it too effectually disposes of the body, rendering certain crimes difficult of detection, would also apply here, and with greater force.

FIRE BURIAL.

§ 19. I pass now to two opposite methods of disposal, the one, fire burial, cremation, or destruction ; the other, embalmment, or the preservation of the dead. In perfect cremation "what the sun has compounded the fire analyseth, not transmuteth." The water of the body is driven off as steam, the nitrogen as nitrogen, the carbon as carbonic acid gas ; the earthy matters alone remain as a white ash.

As in earth burial so in fire burial,* I see no grounds for believing that its origin was other than religious. Writers have ascribed to primitive races a sanitary forethought which they never possessed. The Northmen believed that the soul came down in the lightning to each babe that was born, and that which came down from Heaven in fire should so return. That the Greeks in times of plague, as well as the Hebrews on the field of battle, burnt their dead, was a proceeding more in the nature of a propitiatory sacrifice than founded upon ideas so far in advance of their time as

* "Others conceived it most natural to end in fire, as due unto the master principle in the composition, according to the doctrine of Heraclitus, and therefore heaped up large piles more actively to waft them toward that element, whereby they also declined a visible degeneration into worms, and left a lasting parcel of their composition : 'Hydriotaphia.'"

those of preventive medicine. Early Christianity laid great stress upon the resurrection of the body. The Day of Judgment was considered imminent ; the early Christians may be said for many generations to have lived in daily expectation of the final doom and destruction of all things ; they therefore naturally looked with disfavour on any attempt to disfigure that earthly tabernacle which at the most in a few years was to be retenanted by the soul. But in this century, however strongly people may believe in the tenets of resurrection, to imagine that the unconsumed body is necessary for a participation in resurrection would be to deny the rising of the most eminent saints and martyrs who have been so freely burnt by rival sects. Hence we find members of the churches of England and Rome, and deeply religious men of all persuasions, ready to take a common-sense view of cremation, and whatever objections they may raise against its practice, hitherto there has been no very strong or united opposition on the score of impiety. This, I think, is a matter of congratulation, for such opposition is in its nature permanent, and not to be overcome by argument.

The practical aspects of cremation have recently received a fresh impetus in the form of a declaration by Chief Justice Stephen, to the effect that there was nothing in the English law forbidding cremation ; and by a Bill which was introduced into Parliament, with the object of enacting regulations so as to ensure that the practice of cremation was not applied to the concealment of crime. The Bill was rejected, but the reception it met with in Parliament, the moderation of the discussion, and the general tone of the Press outside, plainly showed what a change had taken place in English opinion since the appearance of Sir Henry Thompson's elegant brochure, and of Mr. Eassie's numerous writings.

The only objection, of course, to cremation, is that the future identification of the dead, and above all the discovery of organic poison in cases where murder has been committed, would be rendered impossible.

The supporters of cremation desire to make it universal, and to encourage especially the poor to avail themselves of this method. If this principle is still to be adhered to, I cannot see any way of examining the corpse before cremation, for the simple reason that all scientific examination must necessarily be expensive. The suggestion of Dr. Cameron, that a medical officer of health's duty would be to properly inspect the body for a fee of five shillings, would not be received favourably by my profession ; on the other hand, if cremation be considered the luxury of those who can afford an extra guinea or so, legislation of an effective character, affording every precaution against the burning of a poisoned body, would be easy. The simplest way would, I think, be to enact that any one desiring the cremation of his friend or relative should give notice to the coroner, who thereupon would direct a medical man to at once visit the case, make a post-mortem, and give the coroner a written report ; upon this report, if favourable, the coroner would give his certificate for the cremation. If there were suspicious circumstances, the coroner would act as in any other case.

The expense of the medical examination would, of course, fall upon the relatives of the deceased.

EMBALMMENT.

§ 20. Embalmment, carried to such a perfection by the Egyptians, like all the rest, depended in its origin upon religious faith. If the Egyptians believed that after numerous metamorphoses, in some three thousand years, the soul would again retenant the body, it was only natural that they should take the most extraordinary pains to preserve that body.

The usual method in the present day is to inject a solution of chloride of zinc, dissolved in alcohol, into the vessels, so that the finest blood channels are filled with the preservative liquid. A corpse thus treated becomes

wonderfully hard and resistant to ordinary processes of decay.

There are many cases in which embalmment may be necessary, such for example as for purposes of identification. I have a strong opinion that all persons found dead in the streets, and not identified, should be injected with a preservative and antiseptic liquid, and remain unburied in some special place for many months; and thus give opportunities of solving the problem of what are called "mysterious disappearances." The transportation of human remains, also, from one country to another necessitates some more scientific method than was adopted in the historical case of the great admiral whose body is said to have been brought home in a barrel of rum.

It is also a question, whether, if vault interments are to continue, some modified form of embalmment should not be rendered compulsory, so as to lessen the risk of injurious emanations.

FUNERALS.

§ 21. I have left for final consideration the general subject of funerals. In Goethe's Autobiography, it is related how a man of fame, wealth, and influence, by the name of Ochsenstein, gave strict directions that after his death he should be carried to the grave in the stillness of early morning, without any pomp, ceremony, or procession. The injunctions strictly followed, in a city remarkable for the display and sumptuousness of its funeral processions, made a profound sensation. In a little while what were satirically called Ox-funerals became frequent, and display generally was diminished.

I would that an English Ochsenstein could be found, and that the same effect would follow.

The anti-Christian origin of the black plumes, the hideous hearse, the hatbands, the mutes, and the general ceremonial has so often been pointed out, that I will not

dwell upon it. The efforts to show respect for the dead are, among the poorer and middle classes, made at the expense of the living ; the portion of the widow and the orphan is cast into the grave, and there buried.

The crowd of gaping, idle people round the door of the darkened house ; the passage of the cortège in the crowded streets, along which no person removes his hat, no carriage, cab, omnibus, or waggon slackens its pace ; the drinking at public-houses of the drivers, mutes, and bearers ; with many other objectionable accompaniments ; show that, from beginning to end, the majority of funeral processions are in ceremonial without meaning, in costume an offence to the eye, and, as a whole, sadly destitute of impressiveness and respect.

A great deal of the display at funerals is for the public gaze, and supposing that funerals took place between 4 and 8 A.M., such a simple alteration would strike a blow at much of the unnecessary expense, and be a first step to reform. There would be also other advantages, such as the non-interference with traffic, the stillness and solemnity of the early morn, the absence of crowds around the house ; and in the case of the poor, the facility that it would give to the working classes to attend a funeral without necessarily losing a day's work.

§ 22. In conclusion, I may say that all who have given any attention to the subject are unanimous in one point only—the necessity of further reform in the present methods of registering the cause of death, and of conducting burial ; but as to the direction reform should take, there is the greatest diversity of opinion. Whether ourselves or our descendants are to be resolved by fire, or buried in sea or earth—so long as the method finally adopted injures not the living ; so long as it preserves decency, and in no way impairs reverence—the outcome of the controversy matters little.



